FINAL DRAFT

ITS Infrastructure Improvement Plan

San Mateo County Alternative Route Plan
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C/CAG
City/County Association of Governments of San Mateo County

ITS Infrastructure Improvement Plan
Table of Contents

SECTION 1 Introduction 2
1.1 PURPOSE 2
1.2 ORGANIZATION OF IMPLEMENTATION PLAN 3
1.3 ACRONYMS 3
SECTION 2 Existing and Planned Systems 4
2.1 TRANSPORTATION SYSTEM CHARACTERISTICS 4
2.1.1 Roadway Network 4
2.1.2 Transit System 5
2.2 TRANSPORTATION OPERATIONS EQUIPMENT AND INFRASTRUCTURE 6
2.2.1 Traffic Signal Controllers 6
2.2.2 Communications Infrastructure 7
2.2.3 ITS Elements 9
SECTION 3 Project Architecture 11
3.1 ITS ARCHITECTURE COMPLIANCE 11
SECTION 4 ITS Technologies and Strategies 14
4.1 ITS ELEMENTS OF THE ALTERNATIVE ROUTE PLAN 14
4.1.1 Closed Circuit Television (CCTV) Cameras 14
4.1.2 Trailblazer Signs (TBS) 16
4.1.3 Ramp Meters 17
4.1.4 Arterial System Detection 17
4.1.5 Advanced At-Grade Crossing Warning and Coordination System 17
4.1.6 Transit Signal Priority (TSP) 18
SECTION 5 Communications Plan 19
5.1 COMMUNICATION REQUIREMENTS 19
5.2 COMMUNICATIONS INFRASTRUCTURE ALTERNATIVES 19
5.2.1 Agency-Owned 19
5.2.2 Leased Network Services 19
5.3 COMMUNICATIONS INFRASTRUCTURE RECOMMENDATIONS 19
SECTION 6 Implementation Plan 20
6.1 PROJECT ELEMENTS 20
6.1.1 Project Grouping 20
6.1.2 Existing and New Project Elements 20
6.2 PROJECT COSTS 20
6.3 IMPLEMENTATION PRIORITY 21
6.4 PROJECT INFORMATION SHEETS 22
Appendix A: Project Information Sheets

SECTION 1 Introduction

1.1 PURPOSE

The purpose of the *ITS Infrastructure Implementation Plan* is to present an implementation strategy for deploying ITS infrastructure elements necessary for full implementation of the San Mateo County Alternative Route Plan. The Alternative Route Plan (started in July 2005) lays out strategies for utilizing ITS elements along alternative local routes to manage traffic during a freeway incident when traffic is diverted off the freeway. These alternative routes were chosen with input by local agencies and seek to minimize the impacts of the diverted traffic onto the local street network. The Alternative Route Plan includes the following freeway segments:

- US Route 101 (US 101)—from San Francisco County border to Santa Clara County border
- Interstate 280 (I-280)—from San Francisco County border to State Route 92
- Interstate 380 (I-380)—from US 101 to I-280
- State Route 92 (SR 92)—from I-280 to the San Mateo Bridge

The ITS infrastructure elements identified in the Alternative Route Plan and presented in this report are used for identifying traffic conditions and directing/managing traffic flows on local streets. These elements include the following:

- <u>Fixed and Pan-Tilt-Zoom (PTZ) Closed Circuit Television (CCTV) Cameras—</u> These devices provide a visual tool for monitoring traffic flow and conditions along the alternative route.
- <u>Trailblazer Signs (TBS)</u>—These devices provide route guidance for drivers along the alternative route. They also direct local street traffic away from entering the impacted freeway section.
- <u>Traffic Signals Coordination</u>—Flush plans along coordinated signals can provide increased throughput capacity along the alternative routes.
- <u>At-Grade Warning Crossing systems and Emergency Vehicle Pre-emption (EVP)/ Transit Signal Priority (TSP) Implementation</u>—These devices are used to enhance the safety of transit vehicles and diverted traffic along the alternative routes.
- <u>Arterial System Detection Stations</u>—These devices may be part of an enhanced system to collect traffic speed and flow data along the alternative route.
- <u>Ramp Metering</u>—These devices adjust the on-ramp flow rate around the incident to manage vehicle flow upstream of the incident and to allow diverted traffic downstream of the incident to enter back on the freeway without delay.
- <u>Communication Networks</u>—Communications between field elements and central coordination facilities provide the backbone for transmitting and disseminating data and video necessary to support the above ITS elements.

The San Mateo County Smart Corridor Project was initiated in Summer 2007 to capitalized on possible funding from the California Traffic Light Signalization Program (part of the Proposition 1B infrastructure bond). The Smart Corridor Project includes ITS elements in Arterial Management, Incident Management, Transit Management, and Traveler Information projects for the County and there is significant overlap of these elements with the *ITS Infrastructure Improvement Plan*. However, the elements and deployment locations between the two plans are not necessarily the same.

1.2 Organization of Implementation Plan

The remainder of this Infrastructure Improvement Plan is organized as follows.

- Section 2 describes the existing and planned systems in the project area
- Section 3 contains the brief discussion of the project architecture
- Section 4 discusses ITS technologies and strategies considered for deployment
- Section 5 discusses the communications alternatives for the project
- Section 6 presents the prioritized list of projects and costs involved with near term and long term projects.
- Section 7 briefly discusses the Operations and Management requirements for the ITS elements after they are deployed

1.3 Acronyms

The following is a list of acronyms frequently used in the report:

BART	Bay Area Rapid Transit
CCTV	Closed Circuit Television
EVP	Emergency Vehicle Preemption
I-280	Interstate Route 280
I-380	Interstate Route 380
IP	Internet Protocol
ITS	Intelligent Transportation System
LED	Light Emitting Diode
NTSC	National Television Standards Committee
O&M	Operations and Management
PTZ	Pan/Tilt/Zoom
RM	Ramp Metering
SIC	Signal Interconnect Cable
SMFO	Single Mode Fiber Optic
SR 92	State Route 92
TBS	Trailblazer signs
TMC	Transportation Management Center
TWP	Twisted Wire Pair
US 101	United State Route 101

SECTION 2 Existing and Planned Systems

There are a number of transportation and ITS-related activities either currently underway or planned in San Mateo County. This project will build on these efforts and integrate with them wherever feasible. The existing transportation systems and related ITS activities are described below.

2.1 TRANSPORTATION SYSTEM CHARACTERISTICS

San Mateo County's transportation system consists of multiple components that function as separate but related systems. In terms of the volume of travel served, the primary components of the County's transportation system are the roadway network and transit system. These components are described in greater detail below.

2.1.1 Roadway Network

Figure 2.1 illustrates the roadway network in San Mateo County. The roadway network consists of two north-south freeways (US 101 and I-280) that run the entire length of San Mateo County; two bridge links (San Mateo Bridge and Dumbarton Bridge); east-west freeway connector routes (I-380 and SR 92); a single, contiguous north-south arterial (El Camino Real); and a host of local routes within each city. Due to the topography of mountains on one side and the Bay on the other, the roadway network is, for the most part, built out within the urban areas of the County. The US 101 and I-280 freeways carry the most regional traffic to and through the County.

From a countywide perspective, these are the most important links within the County. US 101 is the primary travel corridor connecting the North Bay to the San Jose region. It is an eight to ten lane north-south freeway in San Mateo County that carries between 200,000 and 262,000 vehicles per day. In addition to serving transportation needs of the cities along the corridor, it also serves as the primary roadway access road to San Francisco International Airport (SFO), located approximately in the middle of the County near Millbrae.

Interstate 280 is a state highway that provides regional north-south access between San Francisco and the San Jose region. It is a 6 to 12-lane freeway in San Mateo County that carries between 104,000 and 229,000 vehicles per day.

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INCIDENT MANAGEMENT - ALTERNATIVE ROUTE PLAN PROJECT
Fig 2.1 Roadway Network (San Mateo County)

2.1.2 Transit System

San Mateo County is currently served by five different transit systems. The bulk of the local and countywide service is provided by SamTrans, with Caltrain and BART also providing commuter rail and rapid transit facilities.

In the future, as part of Regional Measure 2, commuter ferry service is planned for South San Francisco as well as commuter rail service along the Dumbarton Bridge. In addition, long range plans include a bullet train from San Francisco to Los Angeles, with possible stops in San Mateo County.

San Mateo County Transit District (SamTrans)

SamTrans, designed to serve travelers on the Peninsula between Palo Alto and San Francisco, operates 54 routes. On average, SamTrans buses travel more than 30,000 miles each weekday and carry more than 48,000 passengers. Some points of interest that SamTrans buses travel to include the Bay Meadows race track and the Ano Nuevo State Reserve near Santa Cruz. The district also provides special service to and from Monster Park for 49ers football games and the San Francisco Examiner’s Bay to Breakers foot race. In addition to managing the bus system, SamTrans also administers the Caltrain rail service, operates a shuttle program, and are partners with BART to operate the BART to SFO extension to the new Millbrae Intermodal Station.

Caltrain

Caltrain provides commuter rail service between San Francisco and Gilroy (77 miles of track). Of the 34 stations along the Peninsula, 14 are located within San Mateo County. SamTrans connects with Caltrain at 12 of the train stations (within San Mateo County), or connects within one block of the train station. In 1992, the Peninsula Joint Powers Board (JPB) began to operate Caltrain and agreed to shoulder 100 percent of the operating subsidy a year later. The JPB is made up of three representatives each from San Francisco, San Mateo, and Santa Clara counties. Three of SamTrans Board of Directors represent San Mateo County on the JPB.

Bay Area Rapid Transit (BART)

The BART-SFO extension was completed in 2003. On June 21, 2003 BART started direct service from the airport to downtown San Francisco and the East Bay. The SFO BART station is located in the International Terminal Main Hall and links to the airport's automated people mover system for access to all the terminals, garages, and rental car center. There are six stations within San Mateo County located at Daly City, Colma, South San Francisco, San Bruno, SFO and Millbrae. The Millbrae station includes a cross platform transfer for northbound connections between BART and Caltrain. A mixture of 17 SamTrans bus routes and 19 shuttle routes serve the County's BART stations.

San Francisco Municipal Railway (Muni)

Muni provides two routes to the Daly City BART station: 28 and 54. Route 28 travels between the Marina District in San Francisco and the BART station. Route 54 travels between the Hunter's Point District in San Francisco and the BART station.

Alameda County/Contra Costa County Transit (AC Transit)

AC Transit currently provides limited transit service across the Bay between Alameda County and San Mateo County. Line M travels over the San Mateo Bridge during commute hours with a terminus point at the Hillsdale Shopping Center.

Dumbarton Express

Dumbarton Express provides weekday express bus service across the Dumbarton Bridge, connecting Fremont, Menlo Park, Newark, Palo Alto and Union City (BART station). The service is provided through a consortium of AC Transit, BART, Union City Transit and Santa Clara Valley Transportation Authority.

2.2 Transportation Operations Equipment and Infrastructure

2.2.1 Traffic Signal Controllers

There are currently over 500 traffic signals in San Mateo County. About one-third of these signals are owned and operated by Caltrans along local State Routes. The remaining traffic signal are owned and operated by the local agency; however, none of the agencies utilize a central signal system to operate the traffic signals. All operations are conducted in the field. The signalized intersections in the project area are shown in in Table 2.1.

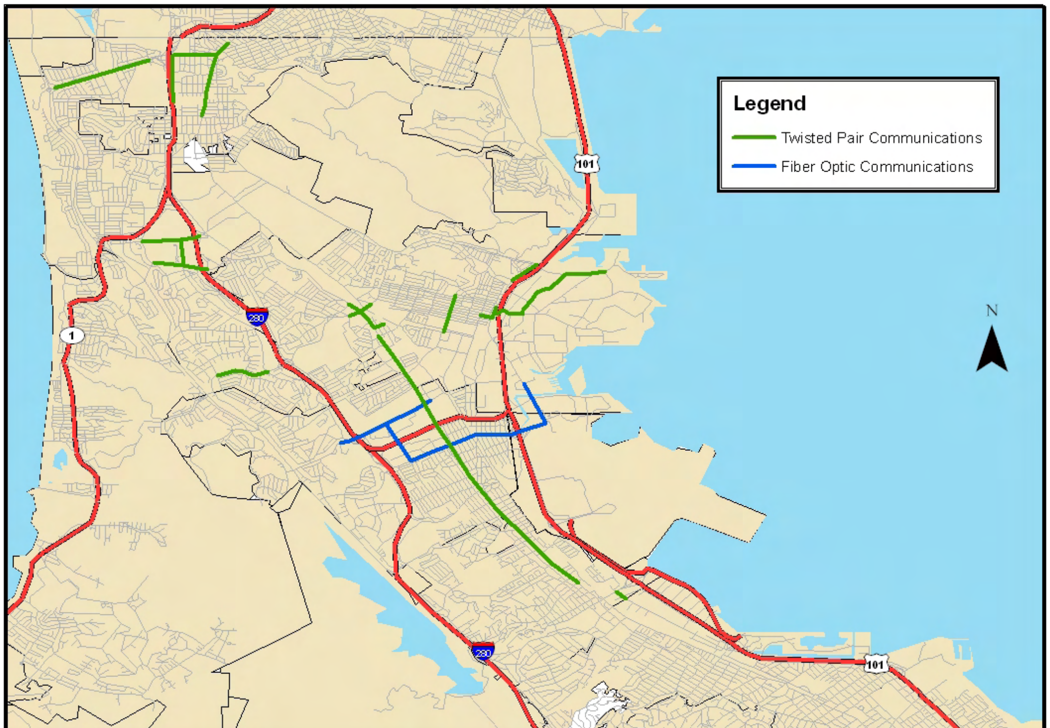
Most of the signals on El Camino Real (Caltrans-owned) are coordinated within each jurisdiction, but the signals are not typically coordinated across jurisdictions.

Table 2.1 San Mateo County Traffic Signals

Jurisdiction	City Owned Signals	Caltrans Owned Signals
Atherton	3	2
Belmont	6	9
Brisbane	9	-
Burlingame	14	-
Colma	6	5
Daly City	39	23
East Palo Alto	7	1
Foster City	19	3
Half Moon Bay	-	4
Hillsborough	-	1
Menlo Park	23	21
Millbrae	4	8
Pacifica	5	6
Portola Valley	-	-
Redwood City	60	25
San Bruno	10	19
San Carlos	15	11
San Mateo	60	29
South San Francisco	60	20
Woodside	1	2

2.2.2 Communications Infrastructure

San Mateo County has both twisted pair and fiber optic communications as shown in the Figures 2.2 and 2.3. The ITS elements on the alternative routes are designed in such a way that the existing communications are effectively utilized.



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INCIDENT MANAGEMENT - ALTERNATIVE ROUTE PLAN PROJECT
Fig 2.2 Existing Communications - North

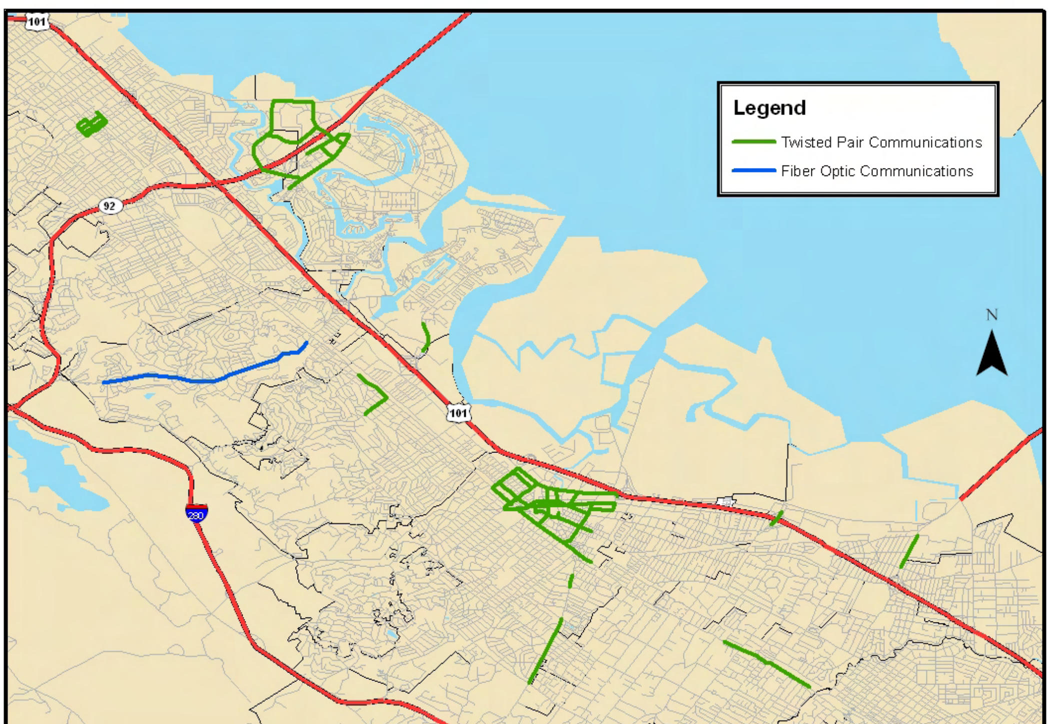

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Fig 2.3 Existing Communications - South

2.2.3 ITS Elements

Caltrans

Caltrans has deployed variety of ITS elements along the freeways in San Mateo County. Figure 2.4 shows the existing CCTV cameras on along US 101, SR 92 and I-380. Some of them are partially operational at the moment; additional work or repairs would be needed to make these fully operational. Also, Caltrans has deployed 26 ramp meters along US Hwy 101 from State Hwy 92 to State Hwy 84.

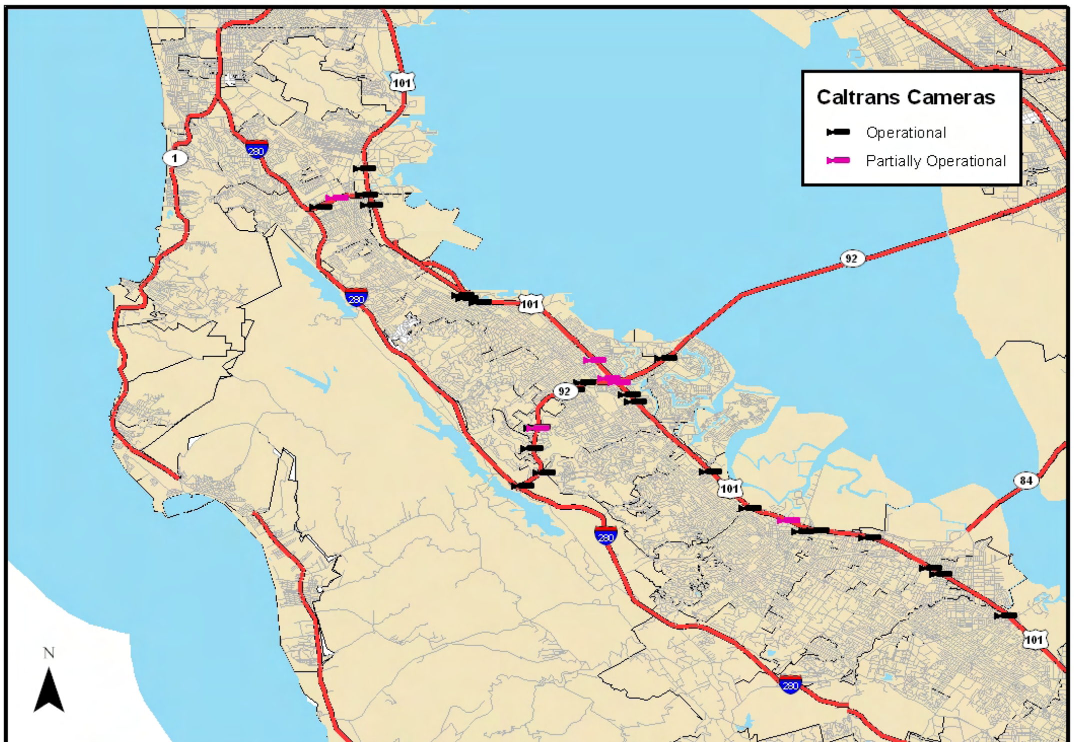

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Fig 2.4 Caltrans Cameras (San Mateo County)

Local Agency (Belmont) elements

In addition to the Caltrans ITS elements, City of Belmont owns 3 CCTV cameras along Ralston Avenue as shown in Figure 2.5

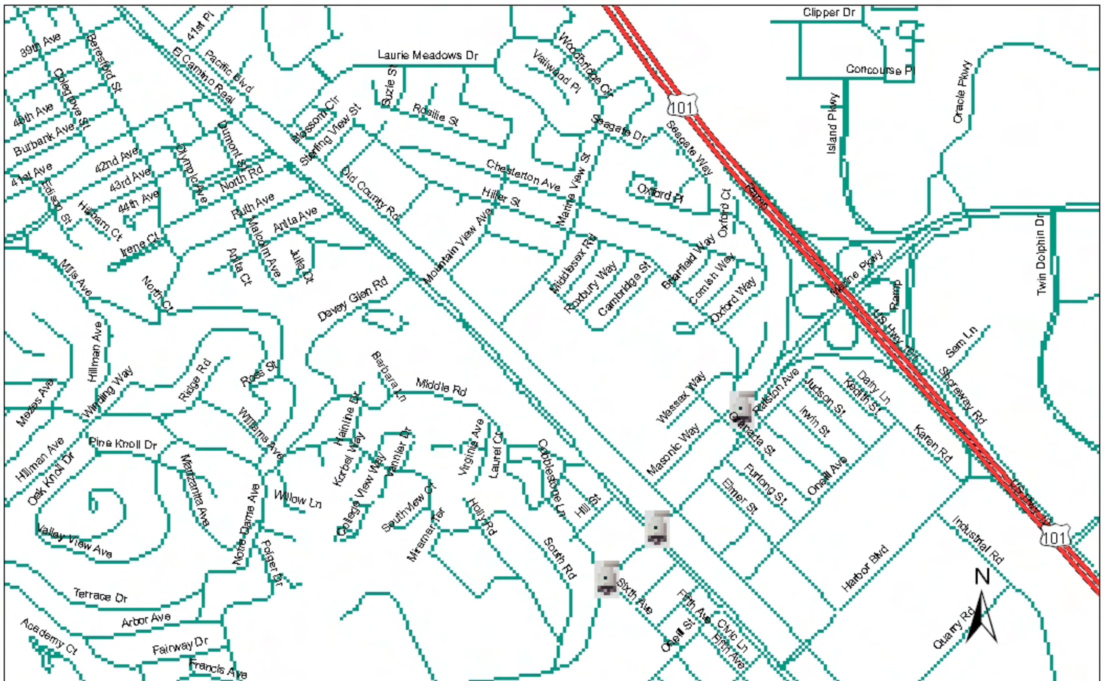

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Fig 2.5 City of Belmont - Existing CCTV Cameras

SECTION 3 Project Architecture

This section describes the high-level ITS project architecture in relation to the National ITS Architecture and the Regional ITS Architecture Update. The purpose of developing an ITS architecture for this project is to ensure the following: 1) compatibility between traffic operations subsystems as elements and systems are being deployed, 2) compliance with national ITS standards, and 3) compatibility of the system with other systems in the Bay Area.

The ITS architecture is a high-level depiction of how system components fit together and interact with each other to make the system work. By defining the connections between subsystems, the architecture identifies where standards may be needed. Also, the architecture development process helps identify additional opportunities for integration that may not have been previously considered. The regional architecture provides an overarching framework that spans all of these organizations and individual transportation projects. Using the architecture, each transportation project can be viewed as an element of the overall transportation system, providing visibility into the relationship between individual transportation projects and ways to cost-effectively build an integrated transportation system over time.

3.1 ITS Architecture Compliance

For San Mateo County and the Alternative Route Plan, the Regional ITS Architecture defines how regional systems may be integrated with one another, and provides guidance on how local systems may also be linked to the regional network. This section references the relevant elements of the National and Regional ITS Architecture to demonstrate that the Alternative Route Plan is being implemented consistently with the architecture.

The physical entities defined in National Architecture Version 5.0 include 22 subsystems, which are grouped into four classes: Centers, Field, Travelers, and Vehicle. The subsystems relevant to the Alternative Route Plan include the following:

Table 5.1: Relevant National ITS Architecture Subsystems

Centers	Emergency Management Traffic Management Transit Management
Field	Roadway Subsystem
Traveler	Personal Information Access Remote Traveler Support
Vehicle	Emergency Vehicle Subsystem Transit Vehicle Subsystem Personal Vehicle

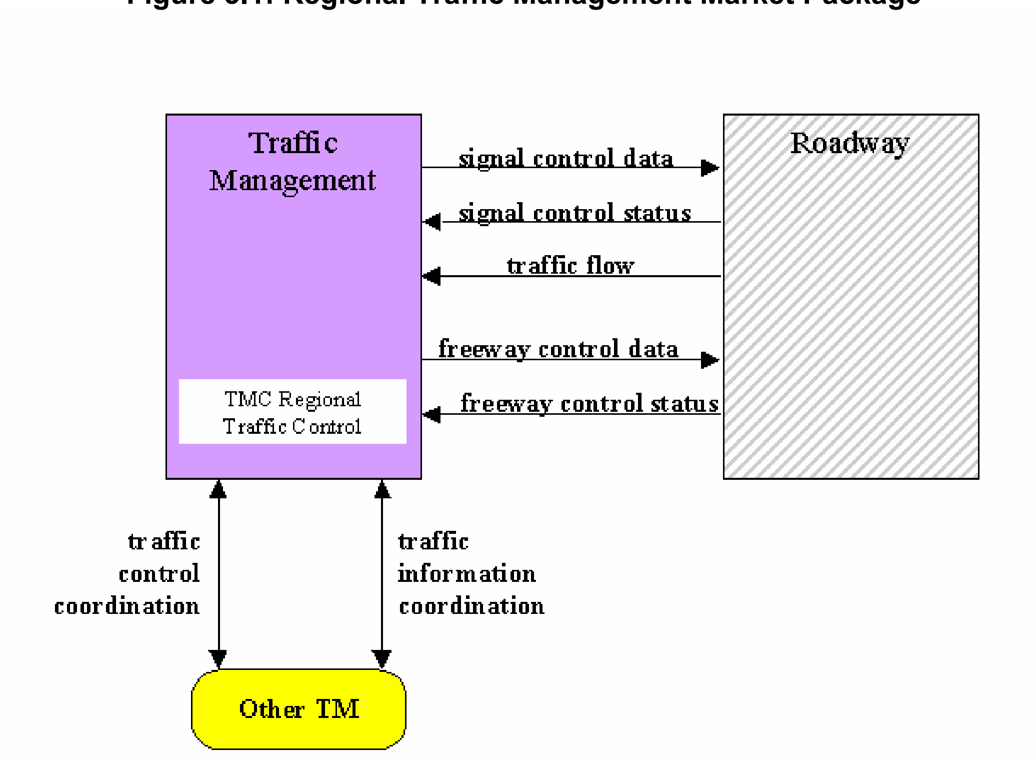
The physical entities in the National Architecture Version 5.0 also include 73 terminators, which define the boundary of the National ITS Architecture. The terminators represent the people, systems, and general environment that interface with ITS. A list of the relevant terminators for the Alternative Route Plan is provided in **Table 5.2**.

Table 5.2: National ITS Architecture Terminators

Environment	Roadway Environment Traffic Vehicle Characteristics
Human	Driver Emergency Personnel Emergency System Operator Emergency Management Operator Traffic Operations Personnel Transit System Operators Transit Vehicle Operators Traveler
Other System	Other EM Other Roadway Other Traffic Management Other Transit Management Other Vehicle
System	Alerting and Advisory Systems Asset Management Basic Transit Vehicle Basic Vehicle Emergency Telecommunications System Enforcement Agency Event Promoters Media Multimodal Crossings Multimodal Transportation Service Provider Other Data Sources Rail Operations

Market packages are details of the architecture that illustrate a group of technologies and data flows based on functionality. Each market package represents a function that can be deployed as an integrated capability. **Figure 3.1** depicts an example of one market package, Regional Traffic Management. Notice that the market package includes subsystems (Traffic Management and Roadway) and terminators (Other TM) and the data flows between them.

Figure 3.1: Regional Traffic Management Market Package



The National ITS Architecture identifies 85 Market Packages. The table below identifies the market packages that are relevant to the Alternative Route Plan.

Table 5.3: National ITS Architecture Market Packages

Market Package	Market Package Name
apts2	Transit Fixed-Route Operations
apts3	Demand Response Transit Operations
apts7	Multi-modal Coordination
atis1	Broadcast Traveler Information
atis2	Interactive Traveler Information
atis3	Autonomous Route Guidance
atis4	Dynamic Route Guidance
atis6	Integrated Transportation Management/Route Guidance
atms01	Network Surveillance
atms03	Surface Street Control
atms04	Freeway Control
atms06	Traffic Information Dissemination
atms07	Regional Traffic Control
atms08	Incident Management System
atms09	Traffic Forecast and Demand Management
atms12	Virtual TMC and Smart Probe Data
em02	Emergency Routing
em08	Disaster Response and Recovery
em09	Evacuation and Reentry Management

SECTION 4 ITS Technologies and Strategies

Based on the characteristics of alternative routes selected, preliminary ITS technologies and strategies have been developed for San Mateo County. These technologies and strategies are the basis for the development of the list of project presented in Section 6.

4.1 ITS Elements of the Alternative Route Plan

Alternative routes typically consist of several components: freeway off-ramp, local street connector to the parallel arterial street, parallel arterial street, local street connector from the parallel arterial street and the freeway on-ramp and freeway on-ramp. The following elements are proposed to be included in the Alternative Route Plan. Although some of these elements do not currently exist along the alternative routes, they will be part of the overall system deployment at some time in the future as the projects defined at the end of this report are implemented.

A workshop was held on 12/11/07 with the stakeholders to discuss various technology and policy issues associated with the San Mateo County Smart Corridor Project. These discussions are the basis for the recommendations for the ITS elements for this report.

4.1.1 Closed Circuit Television (CCTV) Cameras

The purpose of CCTV cameras is to have a visual monitor of traffic flow along the alternative routes. By viewing the traffic flow, effective decisions can then be made as to how to best deal with the situation. To this end, cameras located at major intersections will afford the stakeholders the ability to effectively monitor the traffic at key congestion points and respond accordingly.

The use of CCTV cameras is generally limited to two different system installation types, fixed or dynamic. The use of fixed cameras typically requires several cameras to cover a single viewing area, whereas a single dynamic camera that has pan, tilt, and zoom (PTZ) capabilities can view a larger area with a single camera. Fixed cameras are typically mounted on street light mast arms with one camera for each direction.

The use of CCTV cameras with PTZ will require the following considerations:

- Dynamic cameras will require a communication data link from a central control station to the camera to operate the PTZ functions.
- The use of dynamic cameras to see all of the required viewing area will require manual camera operation, hence an operator in a remote location.

- Cameras mounted with a pan-tilt unit can either be pole top mounted or mounted on a small arm, depending on the location. Those cameras mounted on arms should be dome models.
- The camera should be contained in a pressurized enclosure to protect it from the high humidity of the coastal environment.
- Dynamic cameras mounted within Caltrans right-of-way typically require a separate pole, cabinet, and communications infrastructure, resulting in higher installation costs.

Another consideration for CCTV cameras is the type of technology desired. There are currently four basic CCTV technologies: standard color, standard black and white, dual-mode and Web Cams. The benefits and drawback of each of these technologies is discussed in Table 4.1.

Table 4.1 – CCTV Technologies

Technology	Benefits	Drawbacks
Standard Color	• Very prevalent in the ITS arena • Full color, 30 frame/sec (fps) NTSC video output • Moderately priced	• Not as good in low light conditions as a black and white camera
Standard Black and White	• Good low light capabilities • Relatively inexpensive	• Black and white images only
Dual-Mode*	• Good low light capabilities • Full color when lighting conditions are adequate	• Relatively expensive but costs are coming down
Web Cam**	• Direct connections to Internet Protocol (IP) networks	• Video output quality low compared to other cameras

* This camera operates in the full color mode during periods of ample ambient light and reverts to a higher sensitivity black and white mode under darker lighting conditions.

** Web cams output digital compressed video directly onto Ethernet.

CCTV Recommendations

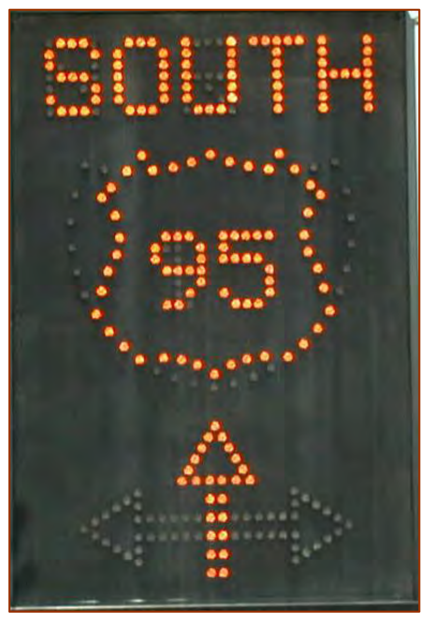
- Deployment of a mix of PTZ and fixed cameras. There is a slight preference toward using fixed cameras only as this video can be easily accessed without the need to aim and focus the view.
- Both PTZ and fixed cameras are recommended to be IP Video cameras.
- Preference for placement of PTZ and fixed cameras on existing poles, if available, near or at intersections, and using existing conduits. Otherwise, a separate, dedicated CCTV pole may need to be installed (similar to a typical luminaire pole without the mast arm.) The camera should still be located near a traffic signal, being certain to avoid any viewing conflicts.

4.1.2 Trailblazer Signs (TBS)

TBS are route guidance signs that assist drivers along a selected alternative route. They provide immediate information to a high volume of traffic at major decision points along the route, enabling drivers to make quick route selections. This operation is preferred over allowing traffic to randomly seek an alternate route when an incident occurs on the freeway. TBS are generally deployed in urban areas at freeway ramps and on parallel surface routes to suggest alternative surface routes for motorists to use during an incident. TBS are typically left blank and when the need arises, a message indicating the alternative route, along with route information, are displayed.

There are four categories of signs that can be utilized as trailblazers: static, blank-out, changeable or variable:

- Static signs are commonly utilized to direct the motorists to freeways and to designate alternate freeway routes. Static signs are displayed to motorists 24-hours a day.
- Blank-out signs are single-message signs that can be turned on and off. The advantage of blank-out signs over static signs is that the route diversion information is only visible to drivers when the signs are on, thus increasing motorist confidence that the information is current and applicable. Typically, the cost for blank-out signs for a given technology is less than changeable or variable message signs due to fewer components.
- Changeable message signs have a pre-determined number of message variations. CMS can display only specific characters or graphics at a particular physical location on the sign as pre-determined prior to the sign's manufacture. For example, a text character at a particular place on the sign may be changed from an "E" to an "N", an "S", or a "W", but not to the letter "G" because this character was not pre-determined as needed, and was not accommodated when the elements of the sign were assembled. LED and fiber optic signs of the non-flip disk variety are typically associated with this category. An example of this type of sign is shown here.



- Variable message signs can display most any character, text, or graphic image anywhere on the sign. This is basically a small version of the freeway changeable message signs. For example, a sign that has a matrix of pixels that can draw any character in the alphabet in the same physical location would be a VMS type. LED, fiber optic with flip-disks or shutters, and liquid crystal display (LCD) signs having complete pixel matrices are examples of variable message signs.

TBS Recommendations

- It is advisable to install a single type of sign through the corridor to assist recognition by diverted drivers and for ease of maintenance.
- There is a preference for a multiple-line text sign that could be used for traveler information for other events like special events or road construction when there are no incidents in the corridor. (Agreement may need to be reached between agencies on the specific purposes for which they can use the trailblazers.)

4.1.3 Ramp Meters

Ramp meters regulate the flow of traffic entering freeways according to current traffic conditions. Ramp metering is a proven strategy to improve freeway speeds, regulate the number of vehicles entering the freeway, and reduce entrance ramp merge accidents.

Caltrans currently has ramp metering deployed in San Mateo County on US 101 between SR 92 and SR 84. Additional ramp metering may be deployed throughout the rest of the County through other Caltrans projects.

RM Recommendations

- *Subject to additional discussion*. Connection to RM (where available) recommended. The stakeholders should work with Caltrans to develop acceptable operational procedures and communications connections.

4.1.4 Arterial System Detection

As the system of ITS elements is deployed and expanded, functionality of the system may also expand. This may include the deployment of system detection at mid-block locations along the local arterial streets to monitor traffic flow and speed along the alternative routes. This can provide stakeholders with valuable additional information to be more proactive in managing arterial traffic.

Arterial System Detection Recommendations

- *Subject to additional discussion.* Deployment of FasTrak readers recommended if there are sufficient vehicles equipped with these tags. It is recommended that portable tag readers be deployed at key locations along El Camino Real and the connector streets in order to sample the existing FasTrak base utilizing the corridor. Further study has to be done extensively on this element before deployment.

4.1.5 Advanced At-Grade Crossing Warning and Coordination System

Caltrain crosses several of the connector roadways at grade. These crossings are currently equipped with standard crossing arms and warning lights. With the Smart Corridor project, additional safety systems and intertie to upstream and downstream signals will be installed to provide additional warning and to prevent vehicles from being trapped on the tracks during periods of unusually high traffic flow during an incident.

Advanced At-Grade Crossing Warning and Coordination System Recommendations

- *Subject to additional discussion.* It is recommended to have additional safety systems and an intertie to upstream and downstream signals to provide additional warning and to prevent vehicles from being trapped on the tracks during periods of unusually high traffic flow during an incident. Further study has to be made on this element prior to making any decision.

4.1.6 Transit Signal Priority (TSP)

The goal of transit priority is to improve transit travel time and assist in schedule adherence by providing priority to transit vehicles. Priority calls are placed by the transit vehicles using an on-vehicle transmitter that sends a signal to detector units located at the intersection or by the bus management AVL system to the traffic signal control system. When a call is received, the transit vehicle obtains priority by receiving additional green time at the end of the priority phase or early green to the priority phase. This allows the transit vehicle to proceed through the intersection at the end of the signal phase when normally it would be required to stop or at the beginning of the priority phase earlier then it would normally be released.

The signal systems operating along the Smart corridors have the capability to upgrade the local controller software to provide transit priority. These priority systems utilize similar methodology and allow the transit priority system to operate within the standard signal system coordination, thus minimizing the impact to the other roadway users. The coordination cycle time is re-allocated from the non-priority phases to the priority phases without adjustment of the cycle length and disruption of the signal coordination.

TSP Recommendations

- *Subject to additional discussion.* There is a slight preference toward an intersection based system as this would be easier to deploy and expand. Further study has to be made on this element prior to making any decision.

SECTION 5 Communications Plan

5.1 COMMUNICATION REQUIREMENTS

A primary component of many ITS applications is the ability to control and communicate with field devices from a central location. A variety of communications media can be used to provide these links. Landline options include traditional twisted pair copper wiring, telephone lines, and fiber optic cable. Wireless options include radio, cellular phone, and satellite systems. Caltrans communications network consists of a mixture of the media.

As noted in the Existing Conditions section, local agencies use different communications media. The most common media is the twisted-pair copper. The transportation related wireline networks deployed by the various jurisdictions within San Mateo County are illustrated in **Figure 2.2 and Figure 2.3** above. As shown in this figure, no comprehensive interjurisdictional network has been deployed.

A number of the jurisdictions within the County have entered into franchise agreements with RCN and Comcast to lease fibers within the networks installed by the companies.

5.2 COMMUNICATIONS INFRASTRUCTURE ALTERNATIVES

This section provides a brief review of the technology that could be utilized for the Alternative Route Plan field elements.

5.2.1 Agency-Owned

Agency-owned infrastructure includes wireline and wireless systems that are owned and maintained by the local agency. Wireline connections via fiber optics or twisted wire pair copper installed in conduit is the ideal solution although it is also the most costly if conduit is not in place. Wireless links like spread spectrum and microwave are very cost effective solutions to an agency-owned system. However, line of sight is the key factor in whether a wireless solution is feasible.

5.2.2 Leased Network Services

Leased line communications is a cost effective solution that typically offers very high bandwidth capacity at attractive monthly leasing costs to government agencies. The drawback to this solution is that the costs are recurring so leasing over a long period of time may not be cost effective.

5.3 COMMUNICATIONS INFRASTRUCTURE RECOMMENDATIONS

Based on the current deployment of agency-owned communications infrastructure, it is likely that the most economical communications solution is to use leased line communications for transmitting data and video from field elements to a remote location. This will need to be assessed on a project-by-project basis and will be dependent on breakeven costs, infrastructure sharing agreements, and status of other communications deployments.

SECTION 6 Implementation Plan

Based on the recommendations provided above in Section 5 ITS elements, an implementation plan has been prepared for San Mateo County. This plan identifies the new ITS elements to be installed along the corridor in order to implement the complete Alternative Route Plan, and provides the various costs associated with it during implementation. The implementation plan is divided into 20 individual projects. Table 6.1 identifies individual projects to implement the ITS Infrastructure Plan. The sections below describe the various elements of the projects.

6.1 PROJECT ELEMENTS

6.1.1 Project Grouping

The individual project limits and content of each project were defined such that the total estimated cost of each project was in the range of $ 1.5 – 2.5 million for construction. This makes each project a reasonable size as a stand-alone project. If more funding was available, adjacent projects could be combined. The ITS elements are grouped along the corridors in such a way that at least one Alternative Route Plan is completed by each project.

6.1.2 Existing and New Project Elements

Each project presented on the list includes existing and new ITS elements along the corridors. The expectation is that existing elements will need some form of integration to become part of the new system, particularly if a new communications infrastructure is added or an existing infrastructure is modified.

Currently, the existing elements include the ramp meters along US Highway 101 from State Highway 92 to State Highway 84; and three PTZ Cameras in the City of Belmont. The project intends to utilize most of the existing communication infrastructure (twisted pair copper and fiber communication) for integrating the new ITS elements.

6.2 PROJECT COSTS

The project costs presented in the table are based on high level planning numbers derived from recent projects in the Bay Area.

The following list shows the cost assumptions that were used to derive the overall project estimates. An additional 15% contingency was added to these costs to account for some escalation and other incidental costs.

Cost per mile of fiber Installation with conduit:	$300,000
Cost per mile of fiber only installation (without conduit)	$20,000
CCTV Field Equipment	$25,000
TBS Field Equipment	$50,000
RM Field Equipment	$20,000
Arterial Detection Field Equipment	$20,000
TSP- minor intersection	$7,500
TSP- major intersection	$10,000
At-grade warning/coordination system	$20,000

Communication costs for connecting and configuring devices to the fiber network are assumed to be 25% of the field device costs. The field construction and communication costs make up the total construction cost for each project.

Engineering costs for developing Project Plans, Specifications and Estimate (PS&E) construction documents are assumed to be 15% of construction cost.

Software development is based on an assumed total development cost of $9,000,000. Software development work include centralized configuration and management control, and center-to-center communication and video sharing. The software development costs have been divided among various projects. There may be higher software development costs for the initial projects, and this cost would be expected to drop as the system expands.

6.3 IMPLEMENTATION PRIORITY

The implementation priority for these projects should account for the following considerations:

- High activity regional destinations (e.g. SFO International Airport)
- Key interchanges and high freeway incident locations (e.g., SR 92 and US 101 interchange)
- Nearby recent or soon-future improvements (e.g. SR 84 and US 101 interchange)
- Existing infrastructure (e.g., US 101 from State Route 84 to Holly Street is has an extensive existing twisted pair infrastructure network)

The implementation priority will be determined by the stakeholders, subject to the considerations above, preferred needs and available funding. Deployment of each project results in the completion of corresponding alternative route(s). At the end of the completion of 20th project, every alternative route plan will be completed as the result of these deployments.

6.4 PROJECT INFORMATION SHEETS

A project information sheet has been prepared for each project in the table. These can be used to quickly convey the scope and elements of each project to decision makers and public meetings. They are provided in Appendix A.

The project sheet includes the following items:

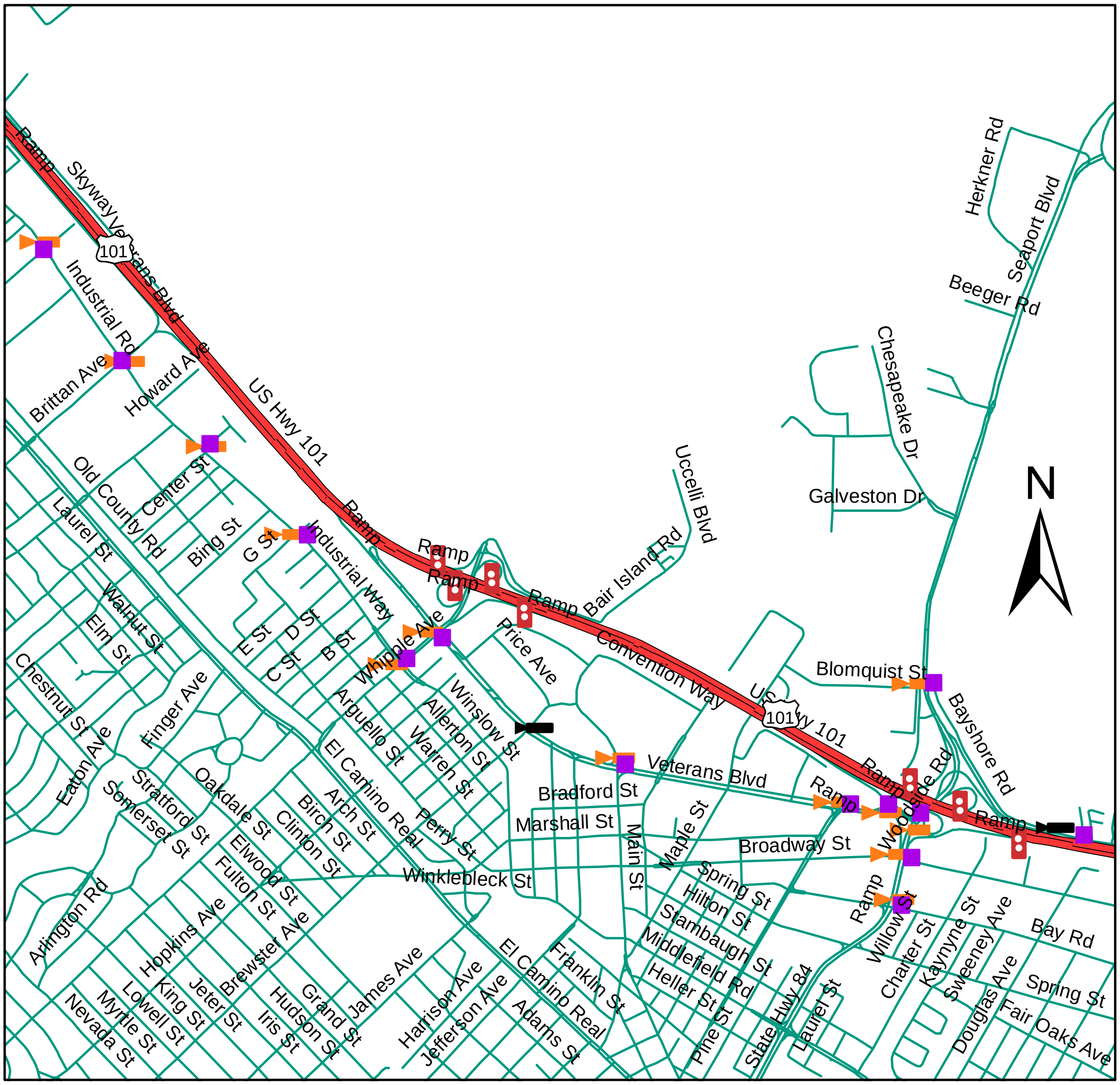
- Project number (priority number of the project)
- Map of the project – shows all the ITS elements (Ramp Meters, PTZ Cameras, Fixed Cameras, Trailblazers) to be deployed in that project
- Geographical limits of the project
- Agencies involved in the implementation of the particular project
- Alternative routes associated with implementation of that project
- Summary of the new field elements to be installed
- Infrastructure type whether it uses fiber / copper / leased line communication
- Estimated costs associated in deploying the project

Table 6.1: Individual Project of ITS Infrastructure Implementation Plan (1/28/08- DRAFT)

					Existing Field Devices					New Field Devices						EVP Upgrade							
Project No.	Route	Limits (Description)	Alternate Route Plans	Agencies	PTZ Camera	Fixed Camera	Traffic Signals	RM	Total Existing Field Devices	PTZ Camera	Fixed Camera	TBS	Connector Controller	At-Grade Crossing System	System Detection along El Camino Real	Light Transit	Heavy Transit	RM	Total New Devices	Construction Cost	Engineering Cost	Software Implementation Cost	Total Cost
1	101	US 101 from Holly St to State Route 84; Veterans Blvd from Whipple Ave to Seaport Blvd. Ramp; Industrial Road from Bransten Rd to Whipple Ave.	101-N-408-1, 101-N-409-1, 101-S-409-1, 101-S-411-1	Redwood City, San Carlos, Menlo Park, Atherton, North Fair Oaks (County)	0	0	20	7	27	3	13	14	5	1	0	0	0	0	36	$1,955,375	$350,000	$100,000	$2,405,375
2	101	US 101 from Hillsdale Blvd to Marine Pkwy; Marine Pkwy/Ralston Ave from El Camino Real to Gordon Ave; El Camino Real from Ralston Ave to Hillsdale Blvd; Hillsdale Blvd from El Camino Real to Norfolk St	101-N-412-1, 101-S-414A-1	Belmont, San Mateo, Foster City, San Carlos	3	0	21	7	31	1	11	20	11	0	0	6	2	0	51	$1,893,250	$330,000	$60,000	$2,283,250
3	101	US 101 from Ralston Ave to Redwood Shores Pkwy; Holly St/Redwood Shores Pkwy between Industrial Rd and Twin Dolphin Dr; various arterials between Ralston Ave and Holly St	101-N-411-1, 101-S-412-1, 101-S-412B-1	Belmont, San Carlos, Redwood City, San Mateo	0	0	11	6	17	6	7	11	7	0	0	2	0	0	33	$1,807,000	$320,000	$60,000	$2,187,000
4	101	US 101 from 3rd Ave to Marsh Rd; Marsh Rd from US 101 to 15th Ave; Bay Rd from 3rd Ave to 5th Ave.	101-N-406-1, 101-N-406-2, 101-S-408-1, 101-S-408-2	Redwood City, Menlo Park, North Fair Oaks (County), Atherton, East Palo Alto	0	0	7	4	11	3	7	12	6	0	0	0	0	0	28	$1,642,000	$300,000	$100,000	$2,042,000
5	101	US 101 from Carlton Ave to University Ave; Saratoga Ave from Green St to State Route 84; State Route 84 from University Ave to Terminal Ave; Bay Rd from US 101 to Irving Ave; University Ave from State Route 84 to Scofield Ave	101-N-403-1, 101-N-404B-1, 101-N-402-1, 101-S-403-1, 101-S-406-2, 101-S-406-3	Menlo Park, East Palo Alto, Santa Clara County, Atherton	0	0	23	11	34	2	13	14	14	0	0	0	0	0	43	$1,890,690	$340,000	$100,000	$2,330,690
6	101, 92	US 101 from 3rd Ave to Hillsdale Blvd; State Route 92 from Delaware St to Taylor St/Holland St; Delaware St from 16th Ave to Saratoga Dr; Saratoga Dr from Delaware St to Hillsdale Blvd	101-N-414A-1, 101-S-414B-1	San Mateo, Foster City	0	0	14	1	15	4	5	21	0	1	0	2	0	3	36	$2,163,570	$380,000	$60,000	$2,603,570
7	101, 380	US 101 from I-380 to SFO; San Bruno Ave from Elm Ave to Airport Blvd; El Camino Real from San Bruno Ave to Sneath Ln; I-380 from 3rd St to Access Rd	101 N-423A-2, 101-S-423B-1, 380-E-5-1	Milbrae, San Bruno, South San Francisco	0	0	20	0	0	1	10	23	7	1	0	6	1	5	54	$2,627,820	$460,000	$75,000	$3,162,820
8	101	US 101 from Millbrae Ave to SFO; Millbrae Ave from El Camino Real to Bayshore Hwy; El Camino Real from Millbrae Ave to San Felipe Ave	101-N-421-1, 101-S-423B-1	San Bruno, South San Francisco, Milbrae, Burlingame	0	0	18	0	0	3	0	19	7	0	3	11	0	3	46	$2,276,063	$400,000	$75,000	$2,751,063
9	101	US 101 from Millbrae Ave to Anza Blvd; Bay Shore Hwy from Broadway to Millbrae Ave; California Dr from Millbrae Ave to Oak Grove Ave; Rollins Rd from David Dr to Broadway; Airport Blvd from Beach Rd to Anza Blvd; Broadway from California Dr to Bayshore Hwy	101-N-419B-1, 101-S-421-1	San Mateo, Burlingame, Milbrae, San Bruno, South San Francisco	0	0	14	0	0	5	4	19	7	1	1	1	0	3	41	$2,232,220	$400,000	$75,000	$2,707,220
10	101	US 101 from Airport Blvd to Trollman Ave; Poplar Ave from San Mateo Dr to US 101; Airport Blvd from Coyote Point Dr to Beach Rd	101-N-417A-1, 101-N-417B-1, 101-S-419B-1	San Mateo, Burlingame, Milbrae	0	0	7	0	0	2	3	14	3	1	1	0	0	2	26	$1,656,720	$300,000	$75,000	$2,031,720
11	101	US 101 from Santa Inez Ave to 3rd Ave; 4th Ave from San Mateo Dr to US 101; 3rd Ave from US 101 to Quebec St	101-N-416-1, 101-S-417-1	San Mateo, Burlingame, Milbrae	0	0	19	0	0	2	3	18	14	1	1	0	0	2	41	$1,946,720	$340,000	$60,000	$2,346,720
12	101	US 101 from Sierra Point Pkwy to Oyster Point Rd; Bayshore Blvd from US 101 to Guadalupe Canyon Pkwy; Oyster Point Blvd from US 101 to Gateway Blvd	101-N-426A-1, 101-S-426-1	Brisbane, South San Franciso	0	0	10	0	0	6	1	18	0	0	0	0	0	5	30	$2,078,690	$370,000	$75,000	$2,523,690
13	101	US 101 from Grand Ave to I-380; Gateway Blvd from Grand Ave to Utah Ave; Airport Blvd from Grand Ave to US 101	101-N-424-1, 101-N-425A-1, 101-S-425B-1, 101-S-425B-2, 101-S-425A-1	South San Francisco, Brisbane	0	0	10	0	0	2	3	20	0	0	0	0	0	3	28	$2,138,070	$380,000	$75,000	$2,593,070
14	92	State Route 92 from Foster City Blvd from Edgewater/Mariners Island Blvd; Edgewater/Mariners Island Blvd from 3rd Ave to Hillside Blvd; Fashion Island Blvd; Bridgepointe Pkwy; Chess Dr; Metro Center Blvd	101-N-414B-1, 92-E-14A-1, 92-W-14B-1	San Mateo, Foster City	0	0	18	0	0	5	10	18	2	0	0	0	0	2	37	$2,200,820	$385,000	$75,000	$2,660,820
15	92	State Hwy 92 from Yew St to Pacific Blvd; 20th Ave from Alameda de Las Pulgas to El Camino Real; Delaware St from Saratoga Dr to 25th Ave; 25th Ave from Saratoga Dr to El Camino Real	101-N-414A-1, 101-N-415-1, 101-S-414B-1, 92-W-14A-1, 92-W-13A-1, 92-W-12C-1, 92-W-12A-1, 92-E-12A-1	San Mateo	0	0	4	0	0	1	5	11	0	0	0	0	0	4	21	$1,742,875	$300,000	$60,000	$2,102,875
16	92	State Route 92 from Ralston Ave to Alameda de Las Pulgas; Alameda de Las Pulgas from State Route 92 to Ralston Ave; Ralston Ave/Polhemus Rd from Bunkerhill Dr to Alameda de Las Pulgas; Hillsdale Blvd from State Route 92 to Alameda de Las Pulgas	92-W-11-1, 92-W-9B-1, 92-E-9A-1, 92-E-10-1, 92-E-11-1	San Mateo, Belmont	0	0	10	0	0	7	7	25	3	0	0	0	0	2	44	$2,820,375	$500,000	$75,000	$3,395,375
17	280	I-280 from Hickey Blvd to John Daly Blvd; Junipero Serra Blvd from John Daly Blvd to Westborough Blvd; Hickey Blvd from Skyline Blvd to Junipero Serra Blvd	280-S-49-1, 280-S-47B-1, 280-N-46-1, 280-N-47-1	Daly City, South San Francisco, Colma	0	0	21	0	0	1	20	23	0	0	0	0	0	4	48	$2,681,940	$470,000	$75,000	$3,226,940
18	280	I-280 from Westborough Blvd to Sneath Ln; Westborough Blvd from Skyline Blvd to El Camino Real; Skyline Blvd from Westborough Blvd to Sneath Ln; Sneath Ln from Skyline Blvd to I-380	280-S-46-1, 280-S-45-1, 280-N-43A-1, 280-N-44-1	South San Francisco, San Bruno	0	0	18	0	0	3	16	21	0	0	0	0	0	2	42	$2,499,820	$440,000	$75,000	$3,014,820
19	280	I-280 from I-380 to Trousdale Dr; San Bruno Ave from Skyline Blvd to Cherry Ave; Skyline Blvd from San Bruno Ave to I-280	280-S-43B-1, 280-S-41-1, 280-N-40-1, 280-N-41-1	San Bruno, Milbrae, Hillsborough, San Mateo, South San Francisco	0	0	4	0	0	4	4	14	0	0	0	0	0	2	24	$1,707,750	$300,000	$75,000	$2,082,750
20	280	I-280 from Trousdale Dr to State Route 92; Skyline Blvd from Trousdale Dr to State Route 92; Polhemus Rd	280-S-39-1, 280-S-36-1, 280-S-34-1, 280-N-33-1, 280-N-34-1, 280-N-36-1	Hillsborough, San Mateo	0	0	2	0	0	5	2	14	0	0	0	0	0	4	25	$1,713,070	$300,000	$75,000	$2,088,070
																							$50,539,838

Project Information Sheet

Project 1



LIMITS:
US 101 from Holly St to State Route 84; Veterans Blvd from Whipple Ave to Seaport Blvd Ramp; Industrial Rd from Bransten Rd to Whipple Ave

Legend

- RAMP METERS
- TRAILBLAZERS
- PTZ CAMERAS
- FIXED CAMERAS

AGENCIES:
REDWOOD CITY
SAN CARLOS
MENLO PARK
NORTH FAIR OAKS (COUNTY)
ATHERTON

ALTERNATE ROUTES:
101-N-408-1; 101-N-409-1;
101-S-409-1; 101-S-411-1

NEW FIELD ELEMENTS:
PTZ CAMERAS - 3
FIXED CAMERAS - 13
TRAILBLAZERS - 14
RAMP METERS - 0
CONNECTOR
CONTROLLERS - 5

AT GRADE CROSSINGS - 1
SYSTEM DETECTION - 0
EVP LIGHT TRANSIT - 0
EVP HEAVY TRANSIT - 0

INFRASTRUCTURE TYPE:

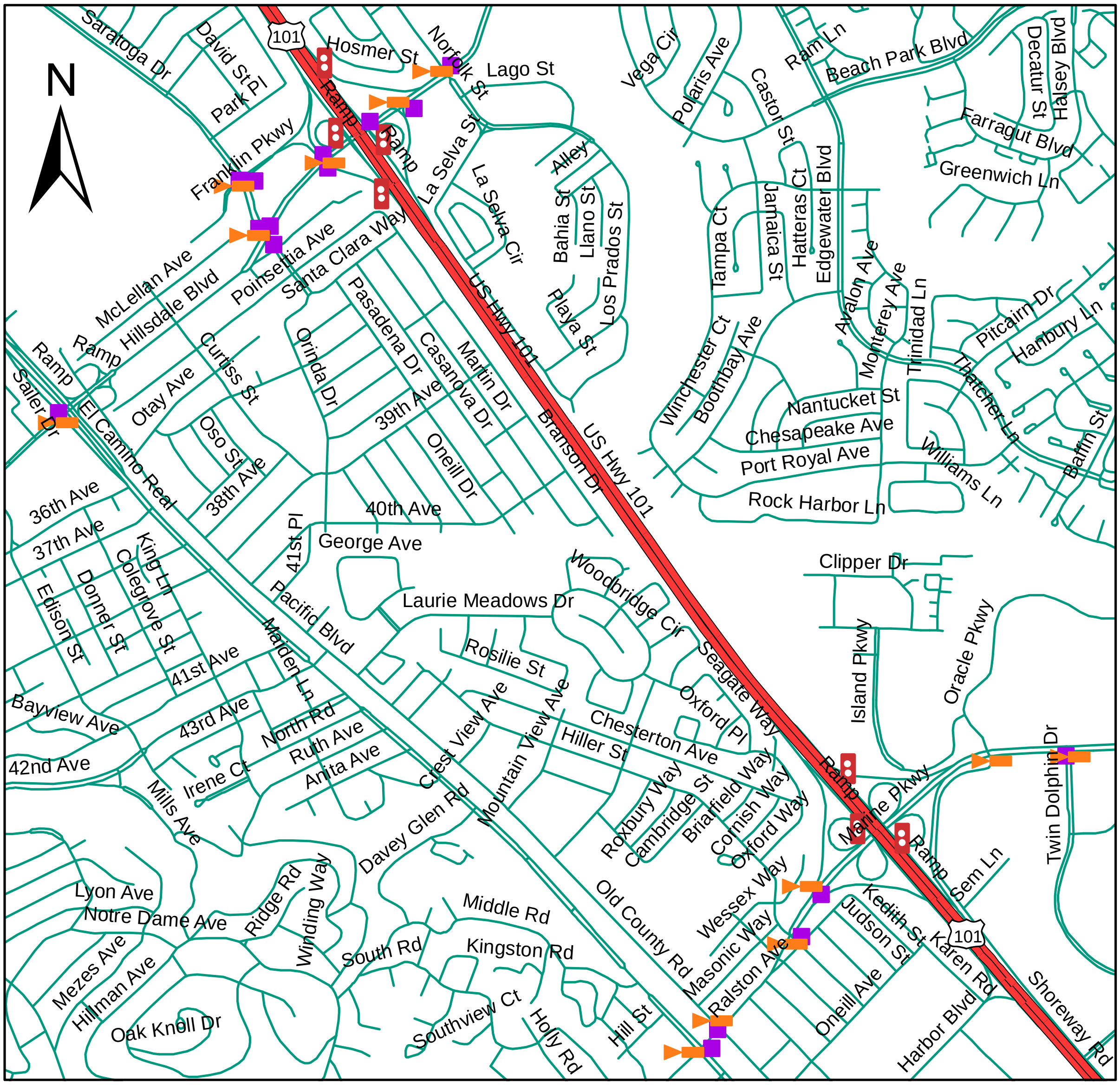
ESTIMATED PROJECT COST:
CONSTRUCTION COST: $ 1, 955,375
ENGINEERING COST: $ 350,000
SOFTWARE DEVELOPMENT COST: $ 100,000

TOTAL IMPLEMENTATION COST: $ 2, 405,375

REVISION DATE 1/22/08

Project Information Sheet

Project 2



LIMITS:
US 101 from Hillsdale Blvd to Marine Pkwy; Marine Pkwy/Ralston Ave from El Camino Real to Gordon Ave; El Camino Real from Ralston Ave to Hillsdale Blvd; Hillsdale Blvd from El Camino Real to NorfolkSt

Legend

- RAMP METERS
- TRAILBLAZERS
- PTZ CAMERAS
- FIXED CAMERAS

AGENCIES:
BELMONT
SAN MATEO
FOSTER CITY
SAN CARLOS

ALTERNATE ROUTES:
101-N-412-1; 101-S-414A-1

NEW FIELD ELEMENTS:
PTZ CAMERAS - 3
FIXED CAMERAS - 13
TRAILBLAZERS - 14
RAMP METERS - 0
CONNECTOR
CONTROLLERS - 11

AT GRADE CROSSINGS - 0
SYSTEM DETECTION - 0
EVP LIGHT TRANSIT - 6
EVP HEAVY TRANSIT - 2

INFRASTRUCTURE TYPE:

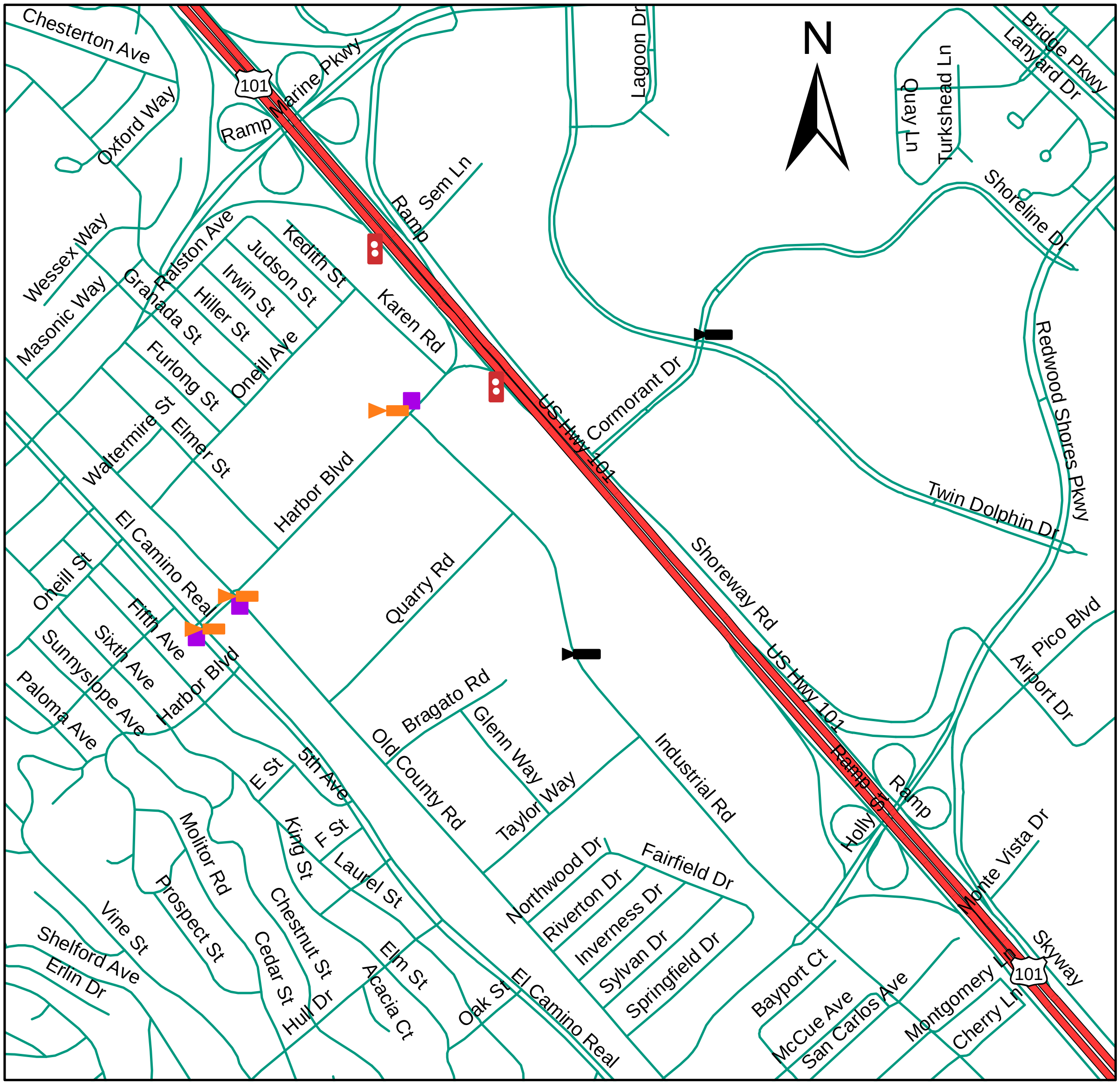
ESTIMATED PROJECT COST:
CONSTRUCTION COST: $ 1, 893,250
ENGINEERING COST: $ 330,000
SOFTWARE DEVELOPMENT COST: $ 60,000

TOTAL IMPLEMENTATION COST: $ 2, 283,250

REVISION DATE 1/22/08

Project Information Sheet

Project 3



LIMITS:
US 101 from Ralston Ave to Redwood Shores Pkwy; Holly St/Redwood Shores Pkwy between Industrial Rd and Twin Dolphin Dr; various arterials between Ralston Ave and Holly St

Legend

RAMP METERS

TRAILBLAZERS

PTZ CAMERAS

FIXED CAMERAS

AGENCIES:
BELMONT
SAN CARLOS
REDWOOD CITY
SAN MATEO

ALTERNATE ROUTES:
101-N-411-1; 101-S-412-1; 101-S-412B-1

NEW FIELD ELEMENTS:
PTZ CAMERAS - 6
FIXED CAMERAS - 7
TRAILBLAZERS - 11
RAMP METERS - 0
CONNECTOR CONTROLLERS - 7

AT GRADE CROSSINGS - 0
SYSTEM DETECTION - 0
EVP LIGHT TRANSIT - 2
EVP HEAVY TRANSIT - 0

INFRASTRUCTURE TYPE:

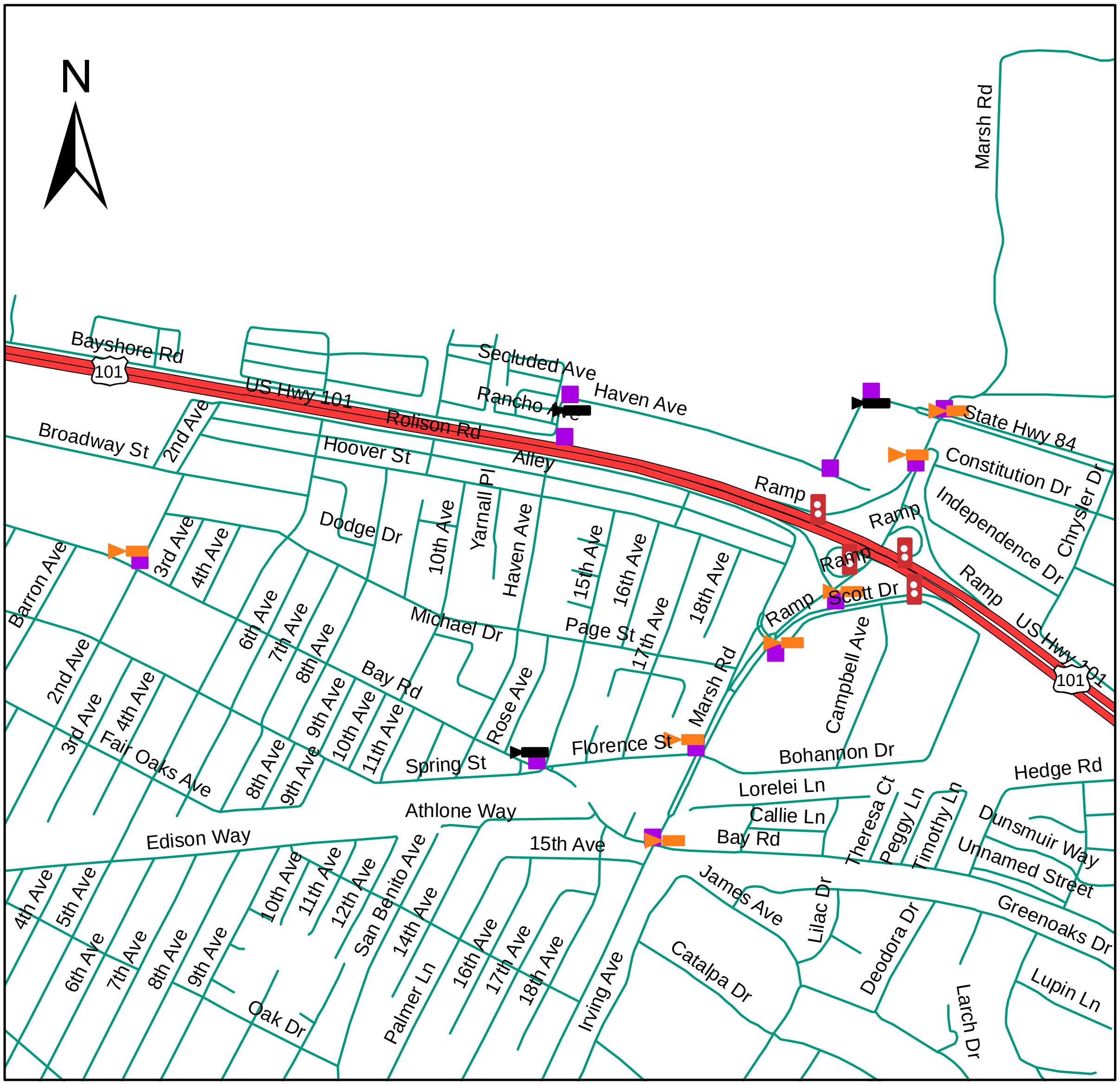
ESTIMATED PROJECT COST:
CONSTRUCTION COST: $ 1, 807,000
ENGINEERING COST: $ 320,000
SOFTWARE DEVELOPMENT COST: $ 60,000

TOTAL IMPLEMENTATION COST: $ 2, 187,000

REVISION DATE 1/22/08

Project Information Sheet

Project 4



LIMITS:
US 101 from 3rd Ave to Marsh Rd; Marsh Rd from US 101 to 15th Ave; Bay Rd from 3rd Ave to 5th Ave

Legend

RAMP METERS

TRAILBLAZERS

PTZ CAMERAS

FIXED CAMERAS

AGENCIES:
REDWOOD CITY
MENLO PARK
NORTH FAIR OAKS
ATHERTON
EAST PALO ALTO

ALTERNATE ROUTES:
101-S-408-1; 101-S-408-2;
101-N-406-1; 101-N-406-2

NEW FIELD ELEMENTS:
PTZ CAMERAS - 3
FIXED CAMERAS - 7
TRAILBLAZERS - 12
RAMP METERS - 0
CONNECTOR
CONTROLLERS - 6

AT GRADE CROSSINGS - 0
SYSTEM DETECTION - 0
EVP LIGHT TRANSIT - 0
EVP HEAVY TRANSIT - 0

INFRASTRUCTURE TYPE:

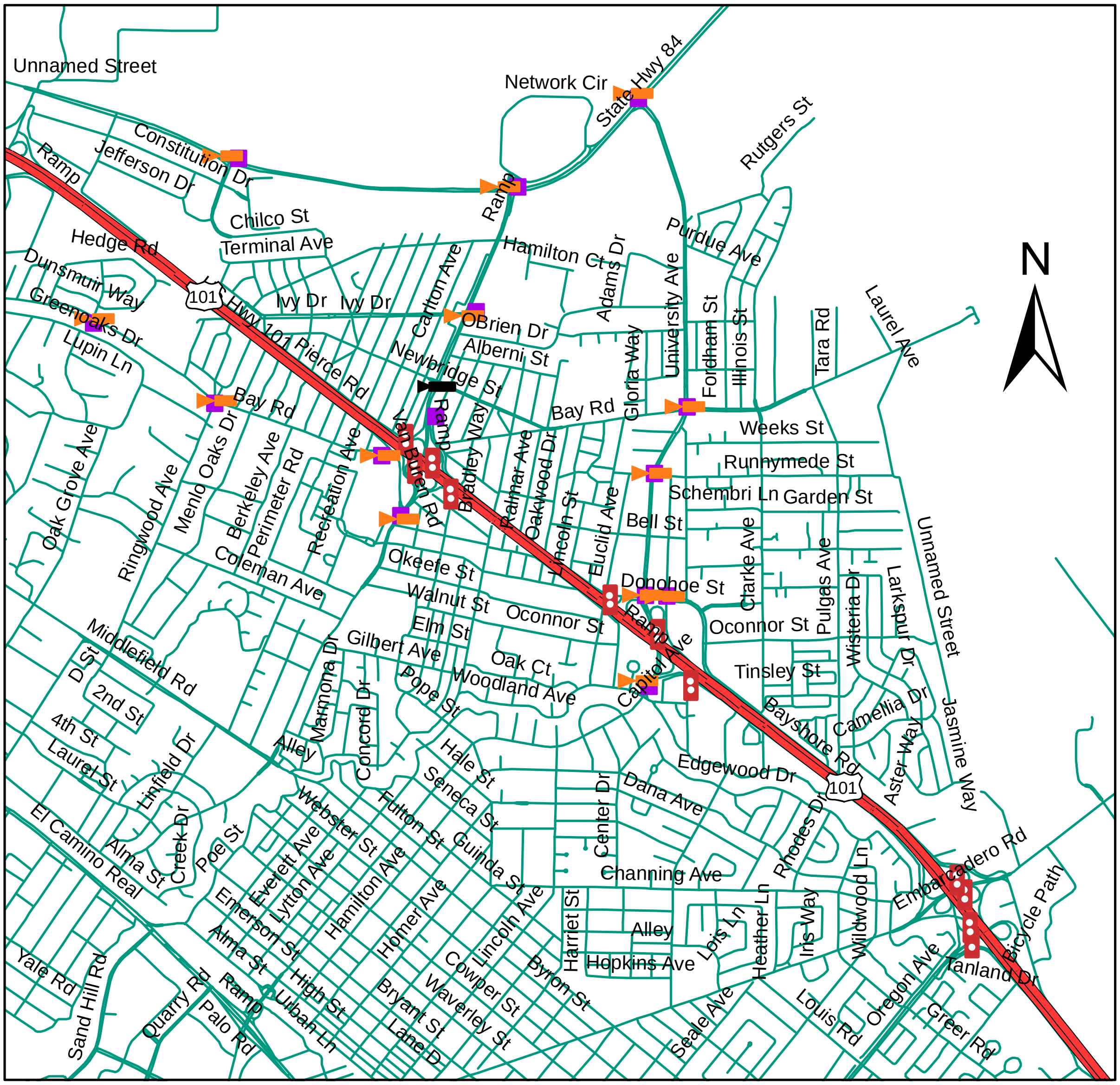
ESTIMATED PROJECT COST:
CONSTRUCTION COST: $ 1, 642,000
ENGINEERING COST: $ 300,000
SOFTWARE DEVELOPMENT COST: $ 100,000

TOTAL IMPLEMENTATION COST: $ 2, 042,000

REVISION DATE 1/22/08

Project Information Sheet

Project 5



LIMITS:
US 101 from Carlton Ave to University Ave; Saratoga Ave from Green St to State Route 84; State Route 84 from University Ave to Terminal Ave; Bay Rd from US 101 to Irving Ave; University Ave from State Route 84 to Scofield Ave;

Legend

- RAMP METERS
- TRAILBLAZERS
- PTZ CAMERAS
- FIXED CAMERAS

AGENCIES:
MENLO PARK
EAST PALO ALTO
SANTA CLARA COUNTY
ATHERTON

ALTERNATE ROUTES:
101-N-403-1; 101-N-404B-1; 101-N-402-1; 101-S-403-1; 101-S-406-W1; 101-S-406-U1

NEW FIELD ELEMENTS:
PTZ CAMERAS - 2
FIXED CAMERAS - 13
TRAILBLAZERS - 14
RAMP METERS - 0
CONNECTOR CONTROLLERS - 14

AT GRADE CROSSINGS - 0
SYSTEM DETECTION - 0
EVP LIGHT TRANSIT - 0
EVP HEAVY TRANSIT - 0

INFRASTRUCTURE TYPE:

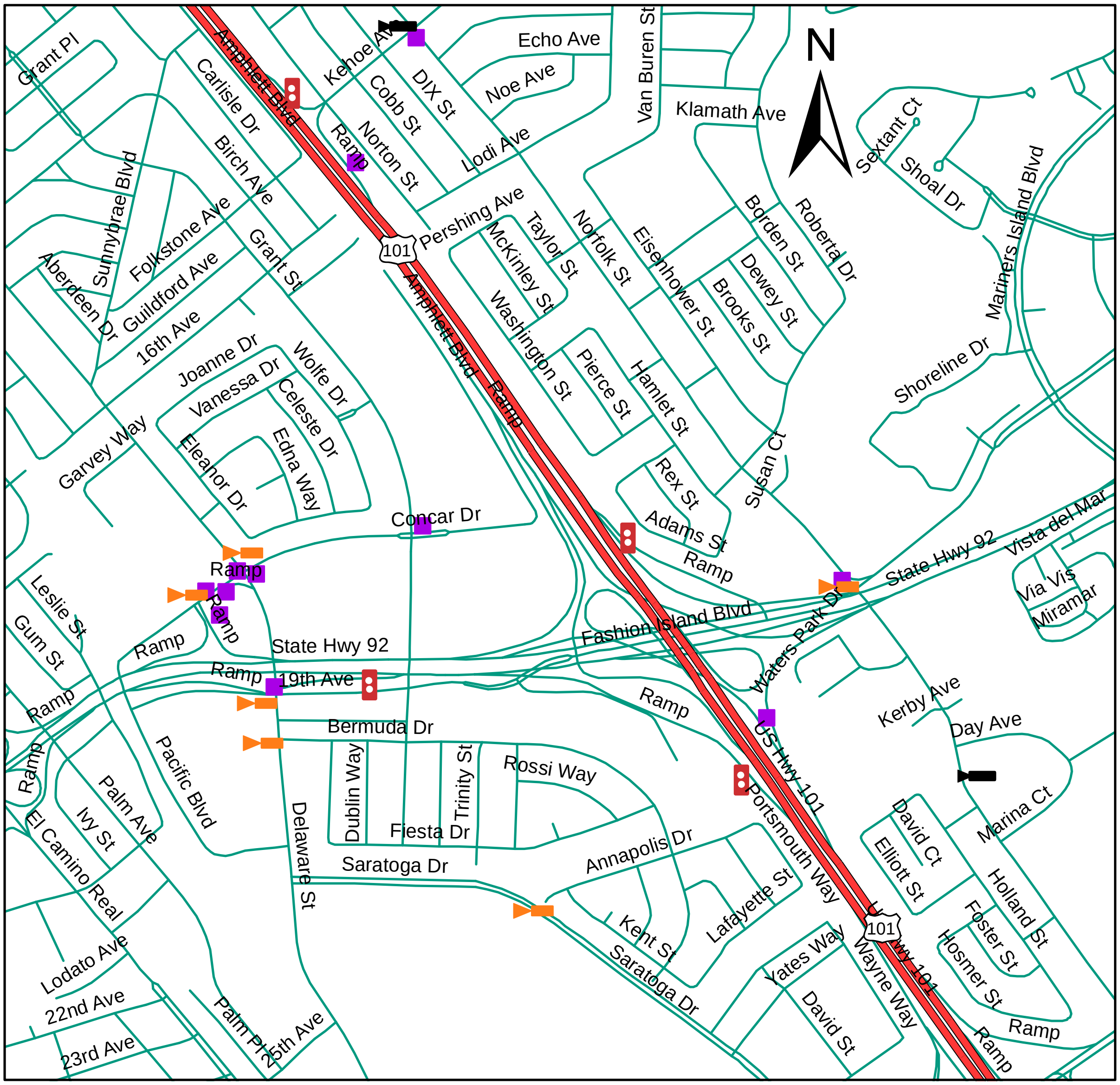
ESTIMATED PROJECT COST:
CONSTRUCTION COST: $ 1, 890,690
ENGINEERING COST: $ 340,000
SOFTWARE DEVELOPMENT COST: $ 100,000

TOTAL IMPLEMENTATION COST: $ 2, 330,690

REVISION DATE 1/22/08

Project Information Sheet

Project 6



LIMITS:
US 101 from 3rd Ave to Hillsdale Blvd; State Route 92 from Delaware St to Taylor St/Holland St; Delaware St from 16th Ave to Saratoga Dr; Saratoga Dr from Delaware St to Hillsdale Blvd

Legend

- RAMP METERS
- TRAILBLAZERS
- PTZ CAMERAS
- FIXED CAMERAS

AGENCIES:
SAN MATEO
FOSTER CITY

ALTERNATE ROUTES:
101-N-414A-1; 101-S-414B-1

NEW FIELD ELEMENTS:
PTZ CAMERAS - 4
FIXED CAMERAS - 5
TRAILBLAZERS - 19
RAMP METERS - 3
CONNECTOR CONTROLLERS - 0

AT GRADE CROSSINGS - 1
SYSTEM DETECTION - 0
EVP LIGHT TRANSIT - 2
EVP HEAVY TRANSIT - 0

INFRASTRUCTURE TYPE:

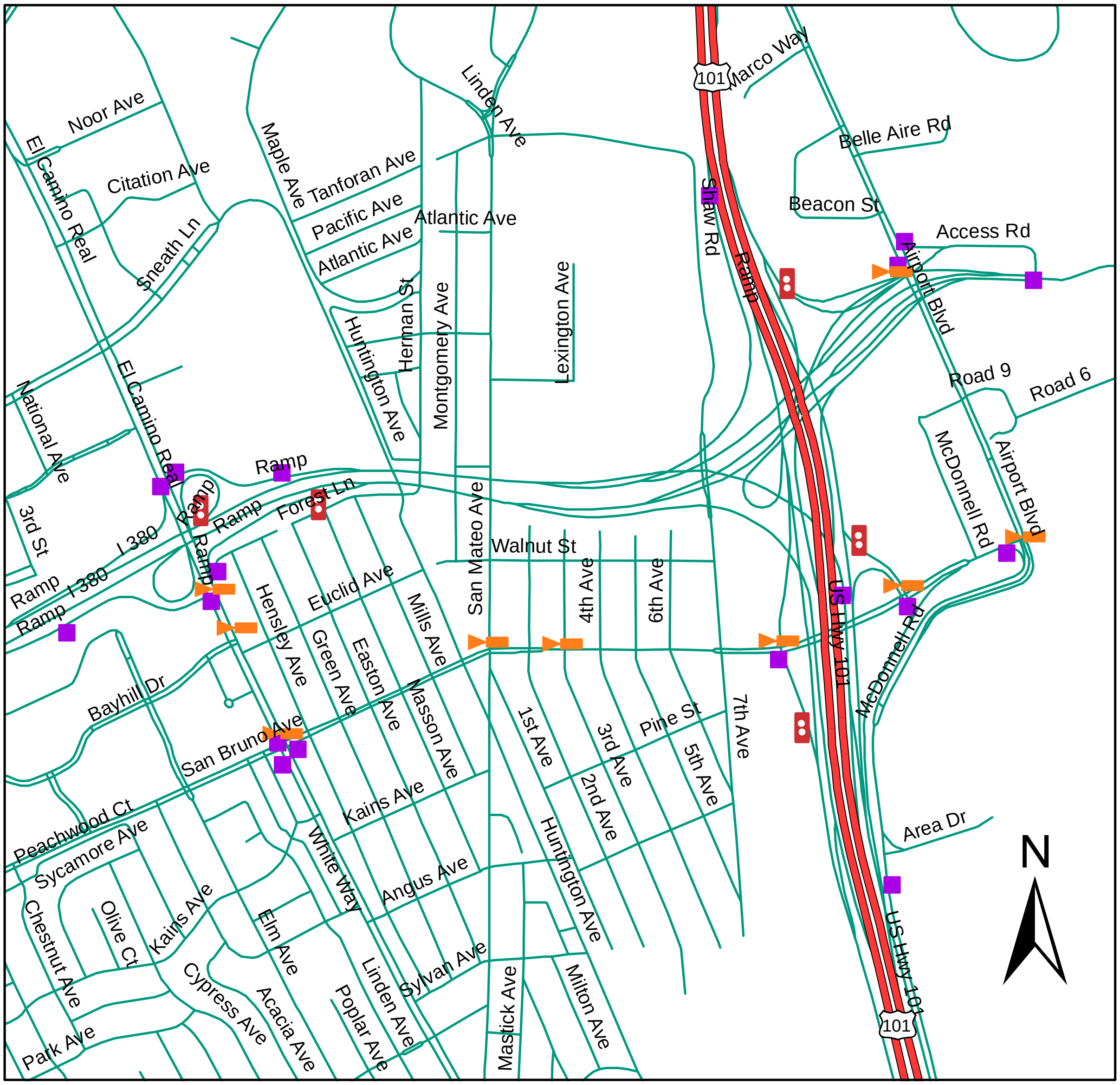
ESTIMATED PROJECT COST:
CONSTRUCTION COST: $ 2, 153,440
ENGINEERING COST: $ 380,000
SOFTWARE DEVELOPMENT COST: $ 60,000

TOTAL IMPLEMENTATION COST: $ 2, 593,440

REVISION DATE 1/22/08

Project Information Sheet

Project 7



LIMITS:
US 101 from I-380 to SFO; San Bruno Ave from Elm Ave to Airport Blvd; El Camino Real from San Bruno Ave to Sneath Ln; I-380 from 3rd St to Access Rd

Legend

RAMP METERS
TRAILBLAZERS
PTZ CAMERAS
FIXED CAMERAS

<u>AGENCIES:</u>
MILBRAE
SAN BRUNO
SOUTH SAN FRANCISCO

<u>ALTERNATE ROUTES:</u>
380-W-423A-1; 380-W-423B-1; 380-E-5-1

<u>NEW FIELD ELEMENTS:</u>
PTZ CAMERAS - 1
FIXED CAMERAS - 10
TRAILBLAZERS - 23
RAMP METERS - 5
CONNECTOR CONTROLLERS - 7

AT GRADE CROSSINGS - 1
SYSTEM DETECTION - 0
EVP LIGHT TRANSIT - 6
EVP HEAVY TRANSIT - 1

<u>INFRASTRUCTURE TYPE:</u>

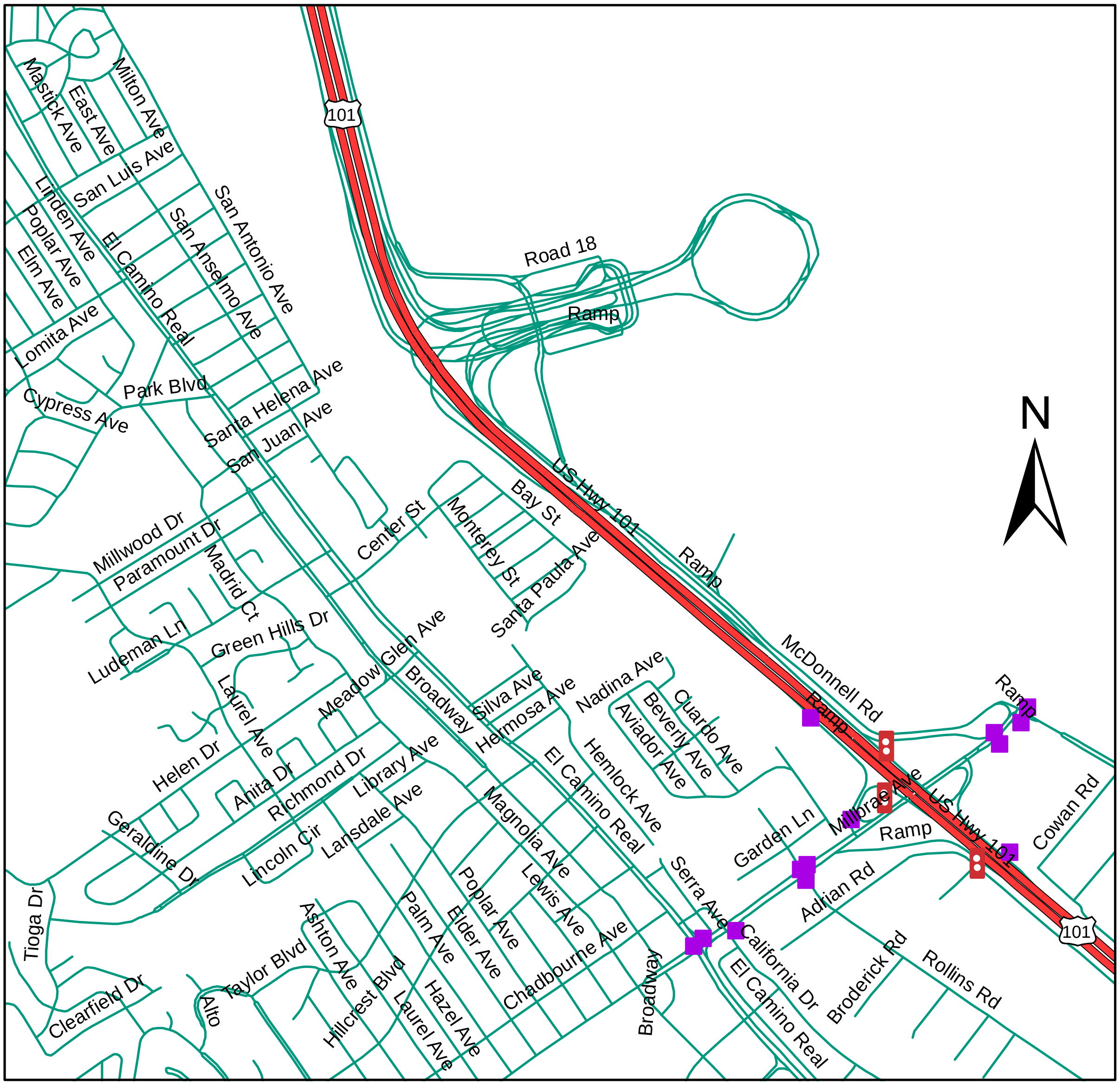
<u>ESTIMATED PROJECT COST:</u>
CONSTRUCTION COST: $ 2, 610,940
ENGINEERING COST: $ 460,000
SOFTWARE DEVELOPMENT COST: $ 75,000

TOTAL IMPLEMENTATION COST: $ 3, 145,940

REVISION DATE 1/22/08

Project Information Sheet

Project 8



LIMITS:
US 101 from Millbrae Ave to SFO; Millbrae Ave from El Camino Real to Bayshore Hwy; El Camino Real from Millbrae Ave to San Felipe Ave

Legend

- RAMP METERS
- TRAILBLAZERS
- PTZ CAMERAS
- FIXED CAMERAS

AGENCIES:
MILLBRAE
SAN BRUNO
SOUTH SAN FRANCISCO
BURLINGAME

ALTERNATE ROUTES:
101-N-421-1; 101-S-423B-1

NEW FIELD ELEMENTS:
PTZ CAMERAS - 3
FIXED CAMERAS - 0
TRAILBLAZERS - 19
RAMP METERS - 3
CONNECTOR
CONTROLLERS - 7

AT GRADE CROSSINGS - 3
SYSTEM DETECTION - 0
EVP LIGHT TRANSIT - 11
EVP HEAVY TRANSIT - 0

INFRASTRUCTURE TYPE:

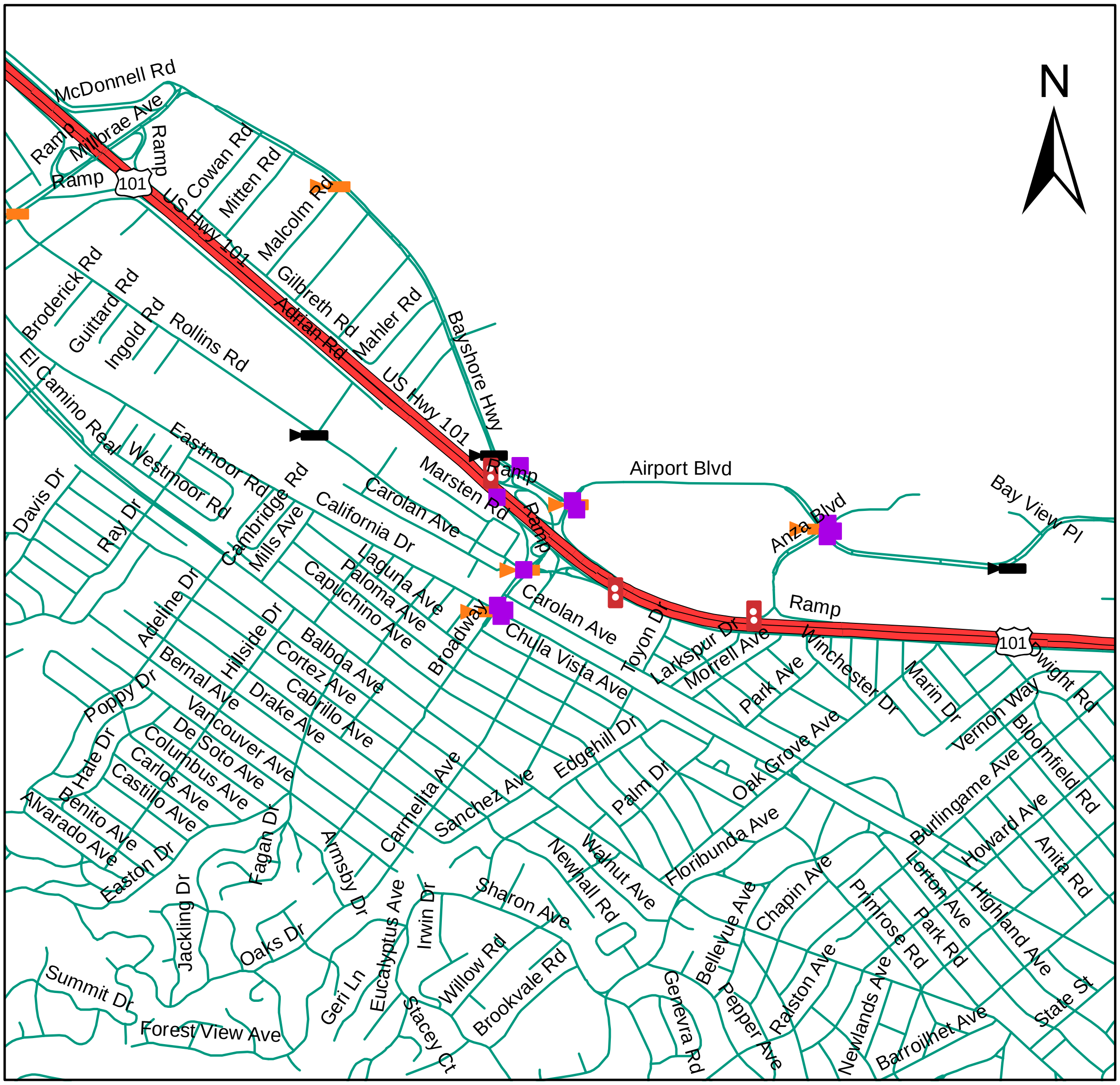
ESTIMATED PROJECT COST:
CONSTRUCTION COST: $ 2, 265,940
ENGINEERING COST: $ 400,000
SOFTWARE DEVELOPMENT COST: $ 75,000

TOTAL IMPLEMENTATION COST: $ 2, 740,940

REVISION DATE 1/22/08

Project Information Sheet

Project 9



LIMITS:
US 101 from Millbrae Ave to Anza Blvd; Bay Shore Hwy from Broadway to Millbrae Ave; California Dr from Millbrae Ave to Oak Grove Ave; Rollins Rd from David Dr to Broadway; Airport Blvd from Beach Rd to Anza Blvd; Broadway from California Dr to Bayshore Hwy

Legend

- RAMP METERS
- TRAILBLAZERS
- PTZ CAMERAS
- FIXED CAMERAS

AGENCIES:
MILLBRAE
SAN BRUNO
SOUTH SAN FRANCISCO
BURLINGAME
SAN MATEO

ALTERNATE ROUTES:
101-N-419B-1; 101-S-421-1

NEW FIELD ELEMENTS:
PTZ CAMERAS - 5
FIXED CAMERAS - 4
TRAILBLAZERS - 19
RAMP METERS - 3
CONNECTOR
CONTROLLERS - 7

AT GRADE CROSSINGS - 1
SYSTEM DETECTION - 1
EVP LIGHT TRANSIT - 1
EVP HEAVY TRANSIT - 0

INFRASTRUCTURE TYPE:

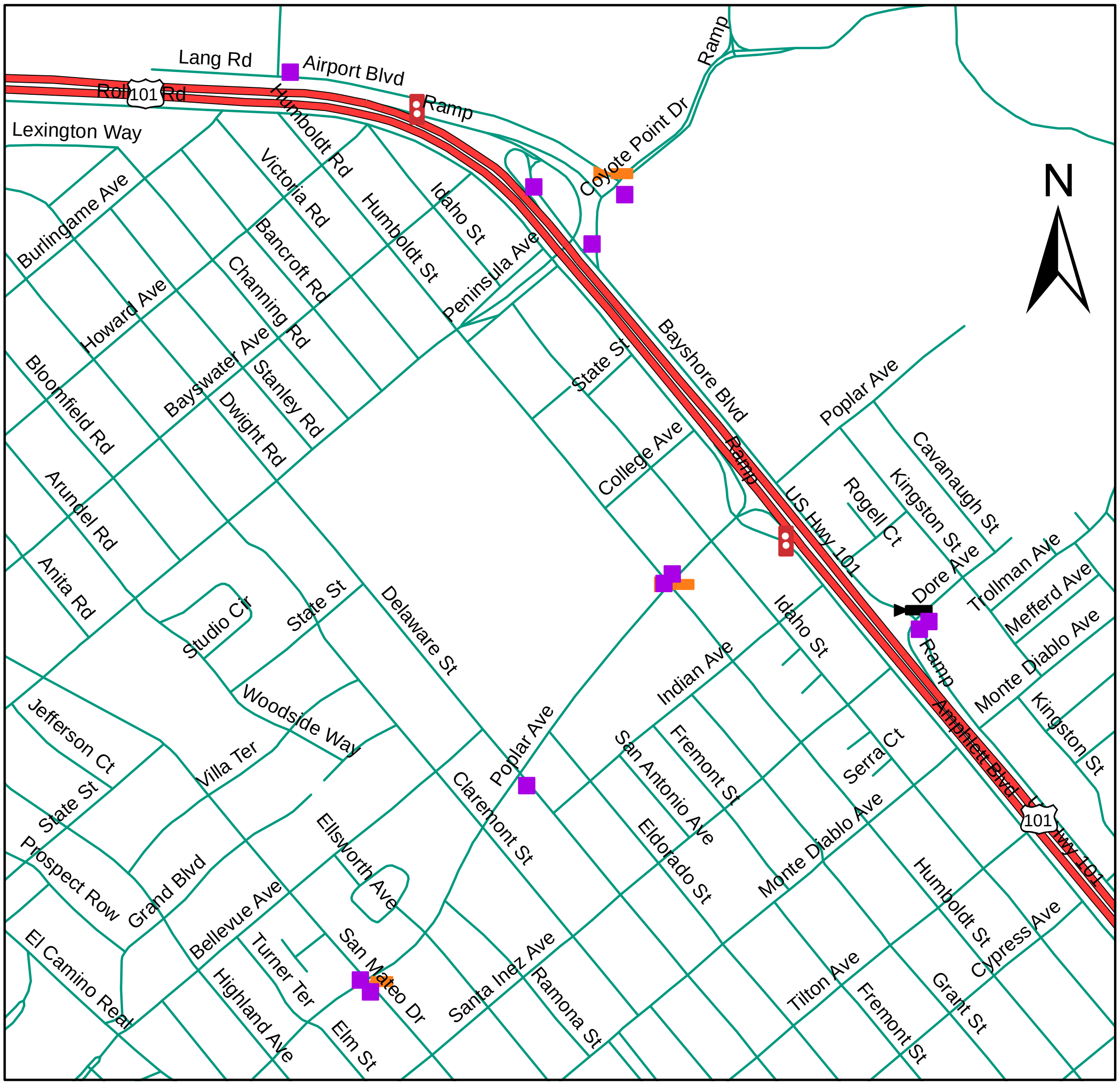
ESTIMATED PROJECT COST:
CONSTRUCTION COST: $ 2,232,220
ENGINEERING COST: $ 400,000
SOFTWARE DEVELOPMENT COST: $ 75,000

TOTAL IMPLEMENTATION COST: $ 2, 707,220

REVISION DATE 1/22/08

Project Information Sheet

Project 10



LIMITS:
US 101 from Airport Blvd to Trollman Ave; Poplar Ave from San Mateo Dr to US 101; Airport Blvd from Coyote Point Dr to Beach Rd

Legend

- RAMP METERS
- TRAILBLAZERS
- PTZ CAMERAS
- FIXED CAMERAS

AGENCIES:
MILLBRAE
BURLINGAME
SAN MATEO

ALTERNATE ROUTES:
101-N-417A-1; 101-N-417B-1; 101-S-419B-1

NEW FIELD ELEMENTS:
PTZ CAMERAS - 2
FIXED CAMERAS - 3
TRAILBLAZERS - 14
RAMP METERS - 2
CONNECTOR CONTROLLERS - 3

AT GRADE CROSSINGS - 1
SYSTEM DETECTION - 1
EVP LIGHT TRANSIT - 0
EVP HEAVY TRANSIT - 0

INFRASTRUCTURE TYPE:

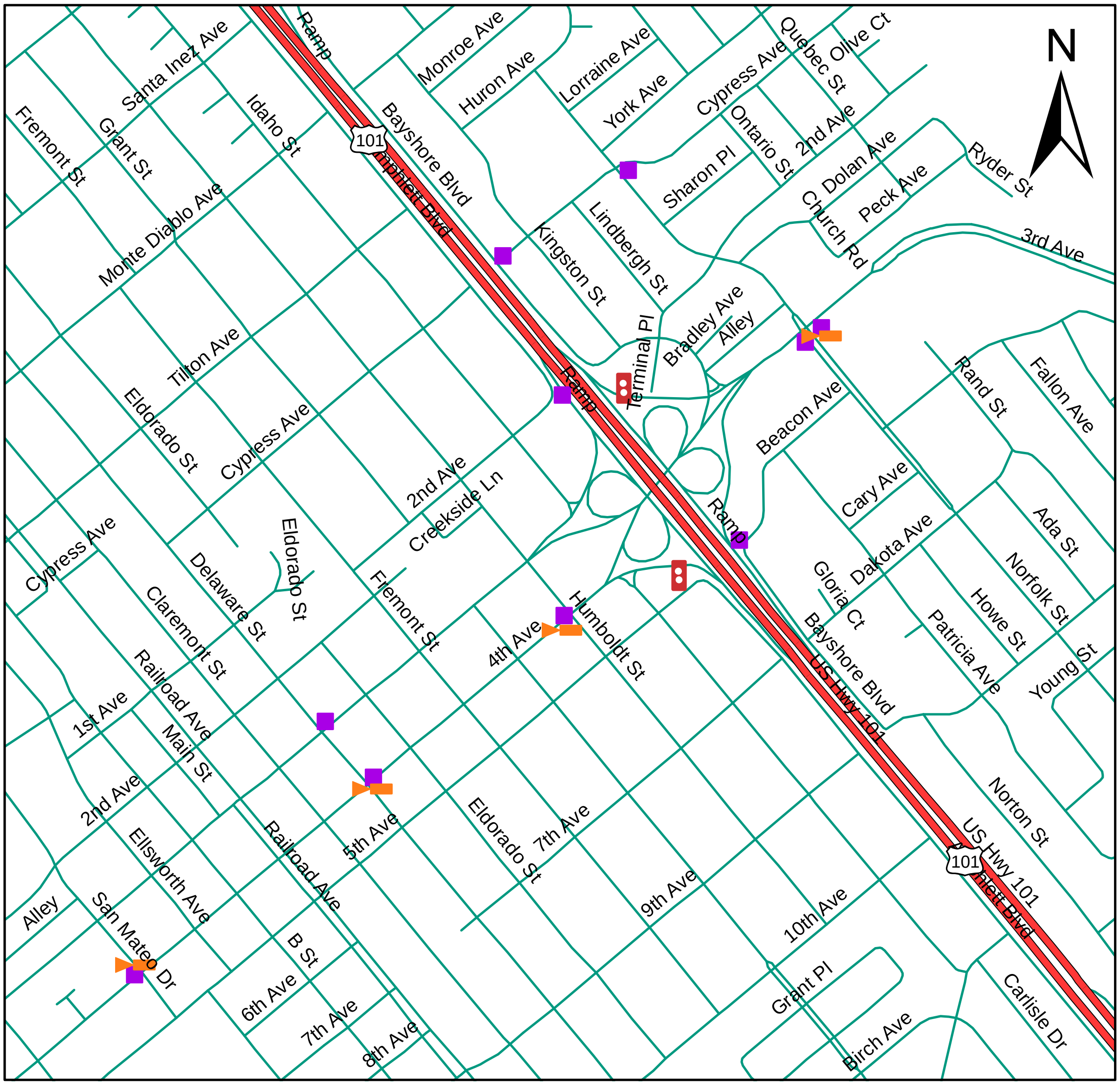
ESTIMATED PROJECT COST:
CONSTRUCTION COST: $ 1, 656,720
ENGINEERING COST: $ 300,000
SOFTWARE DEVELOPMENT COST: $ 75,000

TOTAL IMPLEMENTATION COST: $ 2, 031,720

REVISION DATE 1/22/08

Project Information Sheet

Project 11



LIMITS:
US 101 from Santa Inez Ave to 3rd Ave; 4th Ave from San Mateo Dr to US 101; 3rd Ave from US 101 to Quebec St

Legend

RAMP METERS

TRAILBLAZERS

PTZ CAMERAS

FIXED CAMERAS

AGENCIES:
MILLBRAE
BURLINGAME
SAN MATEO

ALTERNATE ROUTES:
101-N-416-1; 101-S-417-1

NEW FIELD ELEMENTS:
PTZ CAMERAS - 2
FIXED CAMERAS - 3
TRAILBLAZERS - 18
RAMP METERS - 2
CONNECTOR
CONTROLLERS - 14

AT GRADE CROSSINGS - 1
SYSTEM DETECTION - 1
EVP LIGHT TRANSIT - 0
EVP HEAVY TRANSIT - 0

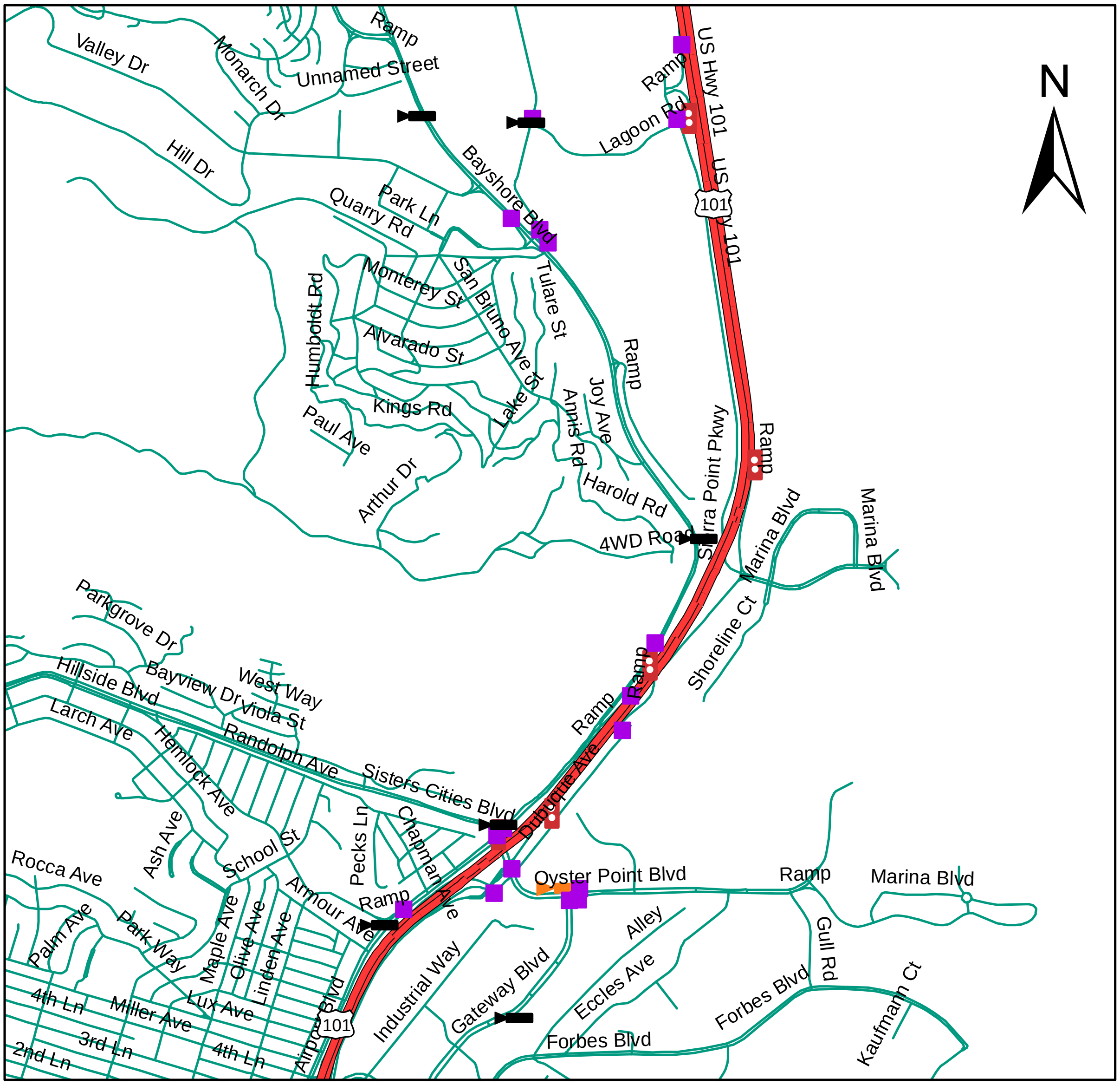
INFRASTRUCTURE TYPE:

ESTIMATED PROJECT COST:
CONSTRUCTION COST: $ 1, 946,720
ENGINEERING COST: $ 340,000
SOFTWARE DEVELOPMENT COST: $ 60,000

TOTAL IMPLEMENTATION COST: $ 2, 346,720

REVISION DATE 1/22/08

Project Information Sheet



Project 12

LIMITS:
US 101 from Sierra Point Pkwy to Oyster Point Rd; Bayshore Blvd from US 101 to Guadalupe Canyon Pkwy; Oyster Point Blvd from US 101 to Gateway Blvd

Legend

RAMP METERS
TRAILBLAZERS
PTZ CAMERAS
FIXED CAMERAS

<u>AGENCIES:</u>
BRISBANE
SOUTH SAN FRANCISCO

<u>ALTERNATE ROUTES:</u>
101-N-426A-1; 101-S-426-1

<u>NEW FIELD ELEMENTS:</u>
PTZ CAMERAS - 6
FIXED CAMERAS - 1
TRAILBLAZERS - 18
RAMP METERS - 5
CONNECTOR
CONTROLLERS - 0

AT GRADE CROSSINGS - 0
SYSTEM DETECTION - 0
EVP LIGHT TRANSIT - 0
EVP HEAVY TRANSIT - 0

<u>INFRASTRUCTURE TYPE:</u>

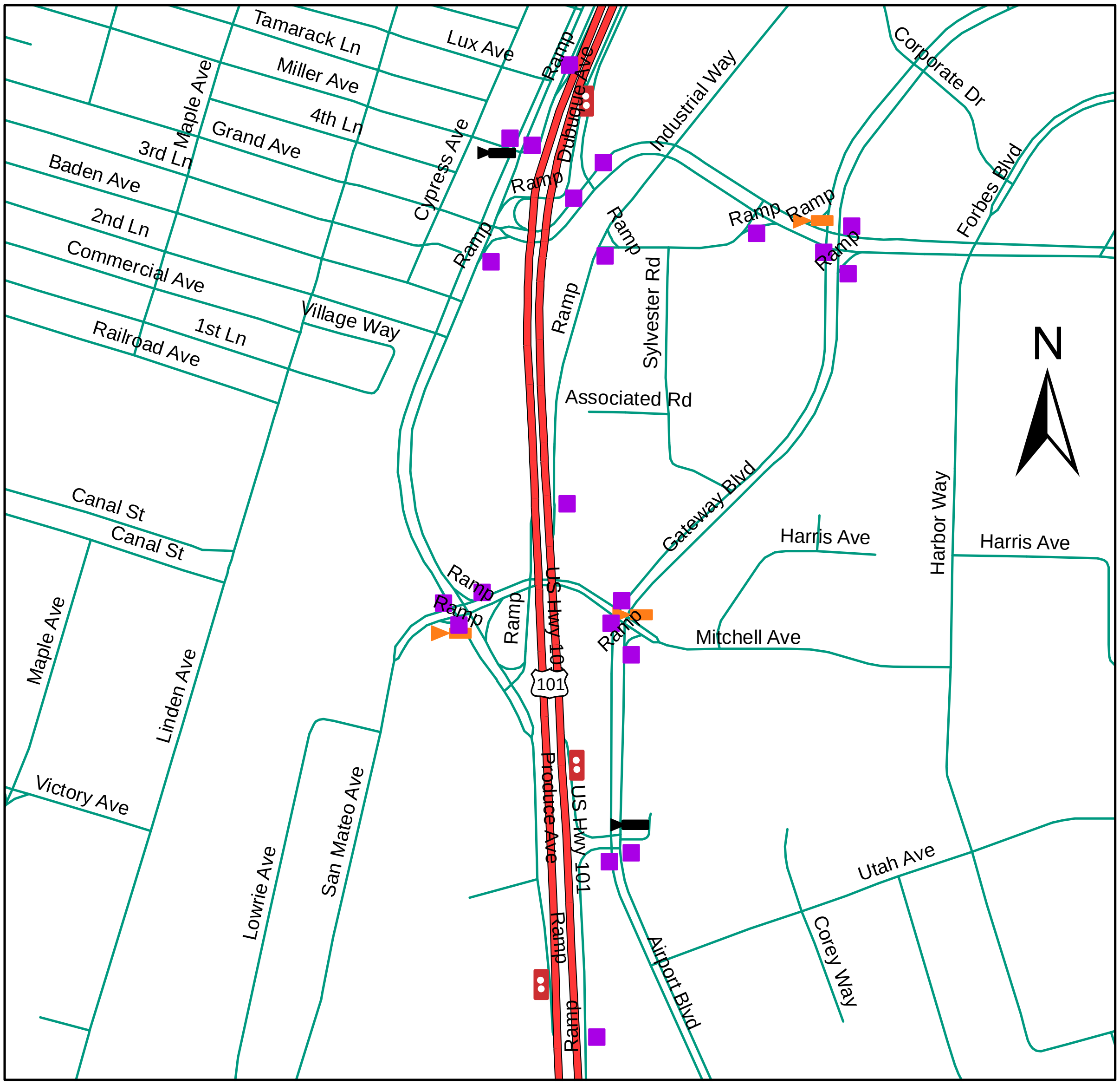
<u>ESTIMATED PROJECT COST:</u>
CONSTRUCTION COST: $ 2, 078,690
ENGINEERING COST: $ 370,000
SOFTWARE DEVELOPMENT COST: $ 75,000

TOTAL IMPLEMENTATION COST: $ 2, 523,690

REVISION DATE 1/22/08

Project Information Sheet

Project 13



LIMITS:
US 101 from Grand Ave to I-380; Gateway Blvd from Grand Ave to Utah Ave; Airport Blvd from Grand Ave to US 101

Legend

- RAMP METERS
- TRAILBLAZERS
- PTZ CAMERAS
- FIXED CAMERAS

AGENCIES:
BRISBANE
SOUTH SAN FRANCISCO

ALTERNATE ROUTES:
101-N-424-1, 101-N-425A-1, 101-S-425B-1, 101-S-425B-2, 101-S-425A-1

NEW FIELD ELEMENTS:
PTZ CAMERAS - 2
FIXED CAMERAS - 3
TRAILBLAZERS - 20
RAMP METERS - 3
CONNECTOR
CONTROLLERS - 0

AT GRADE CROSSINGS - 0
SYSTEM DETECTION - 0
EVP LIGHT TRANSIT - 0
EVP HEAVY TRANSIT - 0

INFRASTRUCTURE TYPE:

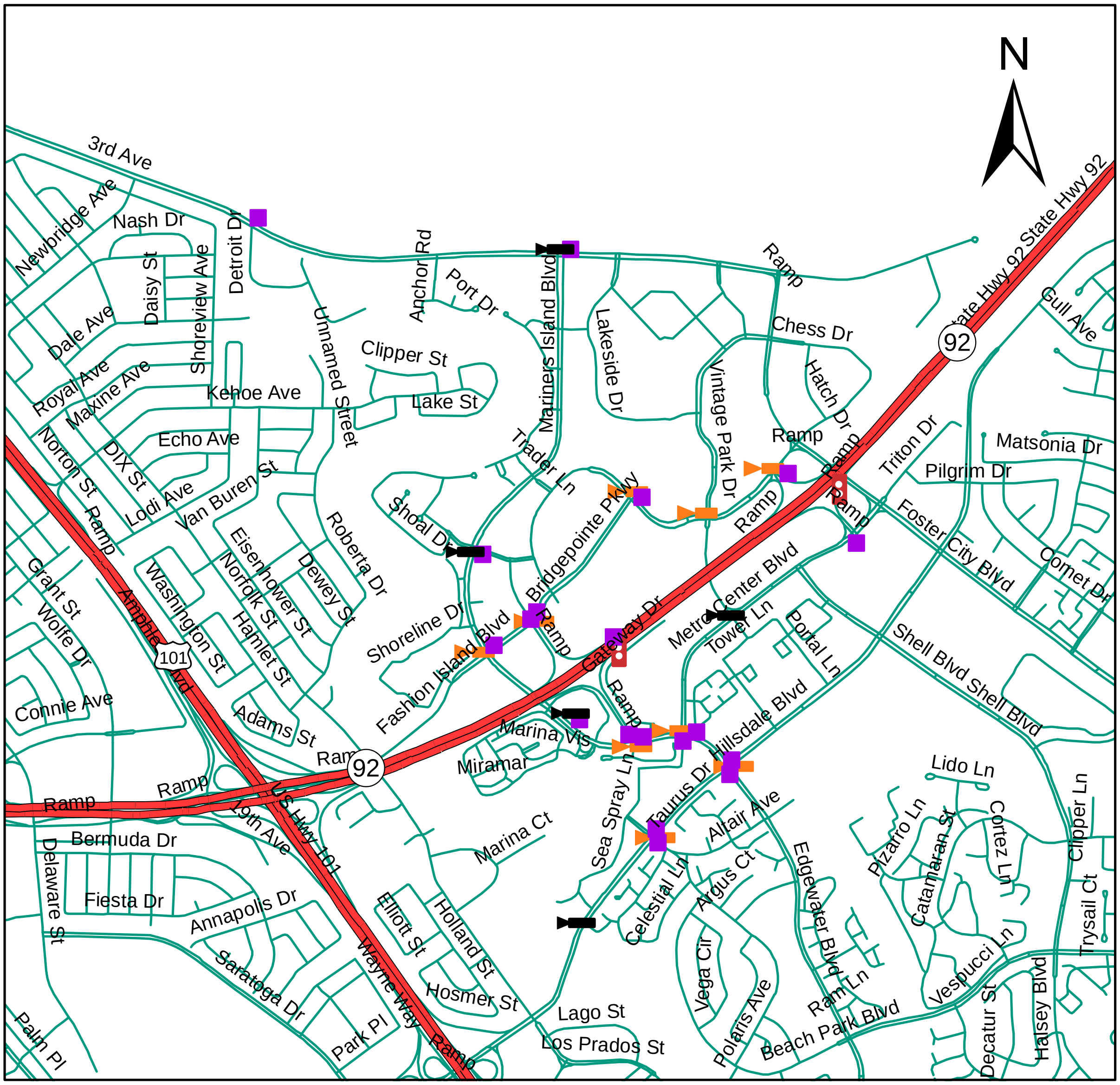
ESTIMATED PROJECT COST:
CONSTRUCTION COST: $ 2, 138,065
ENGINEERING COST: $ 380,000
SOFTWARE DEVELOPMENT COST: $ 75,000

TOTAL IMPLEMENTATION COST: $ 2, 593,065

REVISION DATE 1/22/08

Project Information Sheet

Project 14



LIMITS:
State Route 92 from Foster City Blvd to Edgewater/Mariners Island Blvd; Edgewater/Mariners Island Blvd from 3rd Ave to Hillside Blvd; Fashion Island Blvd; Bridgepointe Pkwy; Chess Dr; Metro Center Blvd

Legend

RAMP METERS

TRAILBLAZERS

PTZ CAMERAS

FIXED CAMERAS

AGENCIES:
SAN MATEO
FOSTER CITY

ALTERNATE ROUTES:
101-N-414B-1, 92-E-14A-1, 92-W-14B-1

NEW FIELD ELEMENTS:
PTZ CAMERAS - 5
FIXED CAMERAS - 10
TRAILBLAZERS - 18
RAMP METERS - 2
CONNECTOR CONTROLLERS - 2

AT GRADE CROSSINGS - 0
SYSTEM DETECTION - 0
EVP LIGHT TRANSIT - 0
EVP HEAVY TRANSIT - 0

INFRASTRUCTURE TYPE:

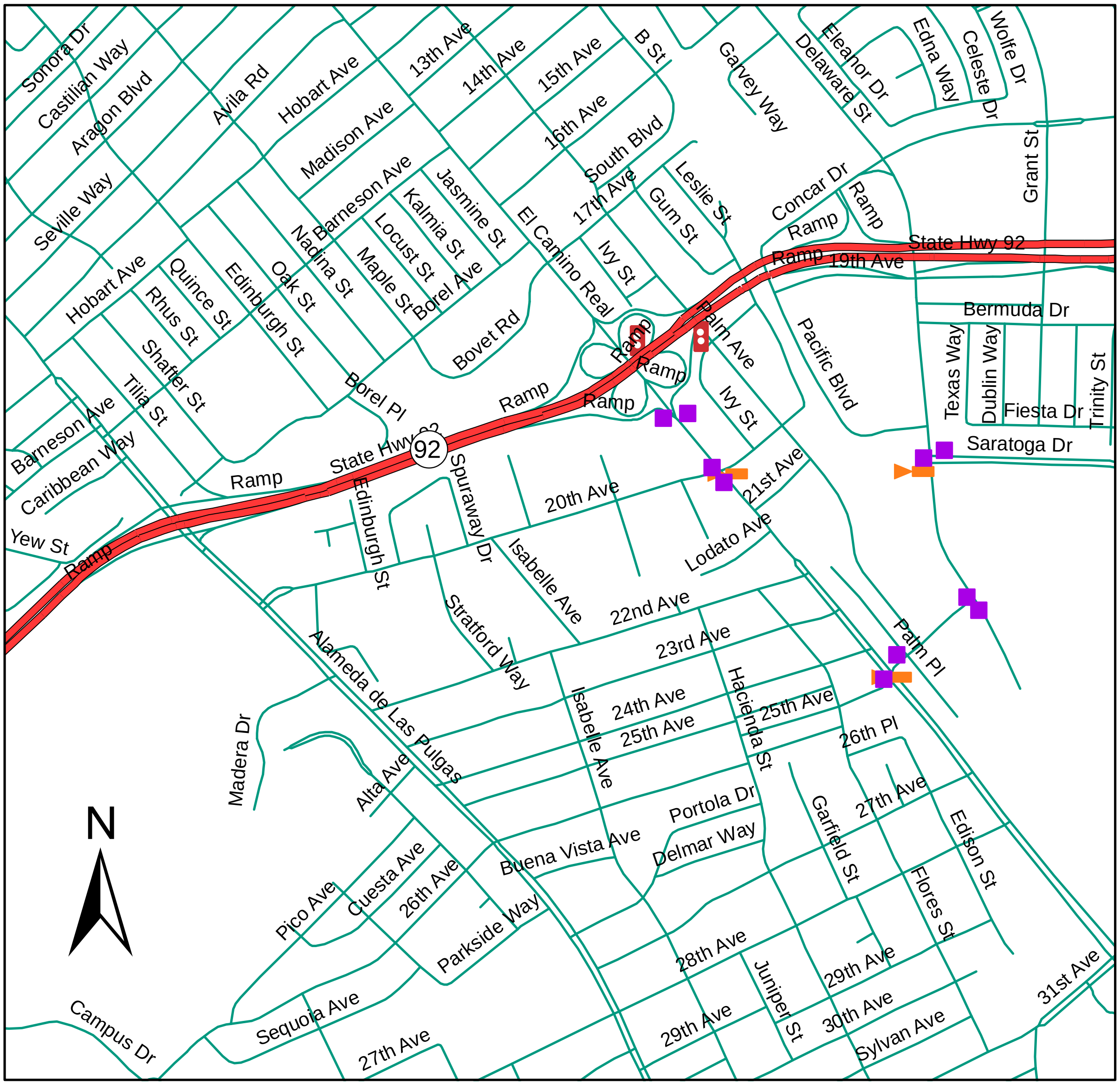
ESTIMATED PROJECT COST:
CONSTRUCTION COST: $ 2, 194,065
ENGINEERING COST: $ 390,000
SOFTWARE DEVELOPMENT COST: $ 75,000

TOTAL IMPLEMENTATION COST: $ 2, 654,065

REVISION DATE 1/22/08

Project Information Sheet

Project 15



LIMITS:
State Route 92 from Alameda de Las Pulgas to El Camino Real; 20th Ave from Alameda de Las Pulgas to El Camino Real; Delaware St from State Route 92 to 25th Ave; El Camino Real from State Route 92 to 25th Ave

Legend

RAMP METERS
TRAILBLAZERS
PTZ CAMERAS
FIXED CAMERAS

AGENCIES:
SAN MATEO

ALTERNATE ROUTES:
101-N-414A-1, 101-N-415-1, 101-S-414B-1, 92-W-14A-1, 92-W-13A-1, 92-W-12C-1, 92-W-12A-1, 92-E-12A-1

NEW FIELD ELEMENTS:
PTZ CAMERAS - 1
FIXED CAMERAS - 5
TRAILBLAZERS - 16
RAMP METERS - 4
CONNECTOR CONTROLLERS - 0

AT GRADE CROSSINGS - 0
SYSTEM DETECTION - 0
EVP LIGHT TRANSIT - 0
EVP HEAVY TRANSIT - 0

INFRASTRUCTURE TYPE:

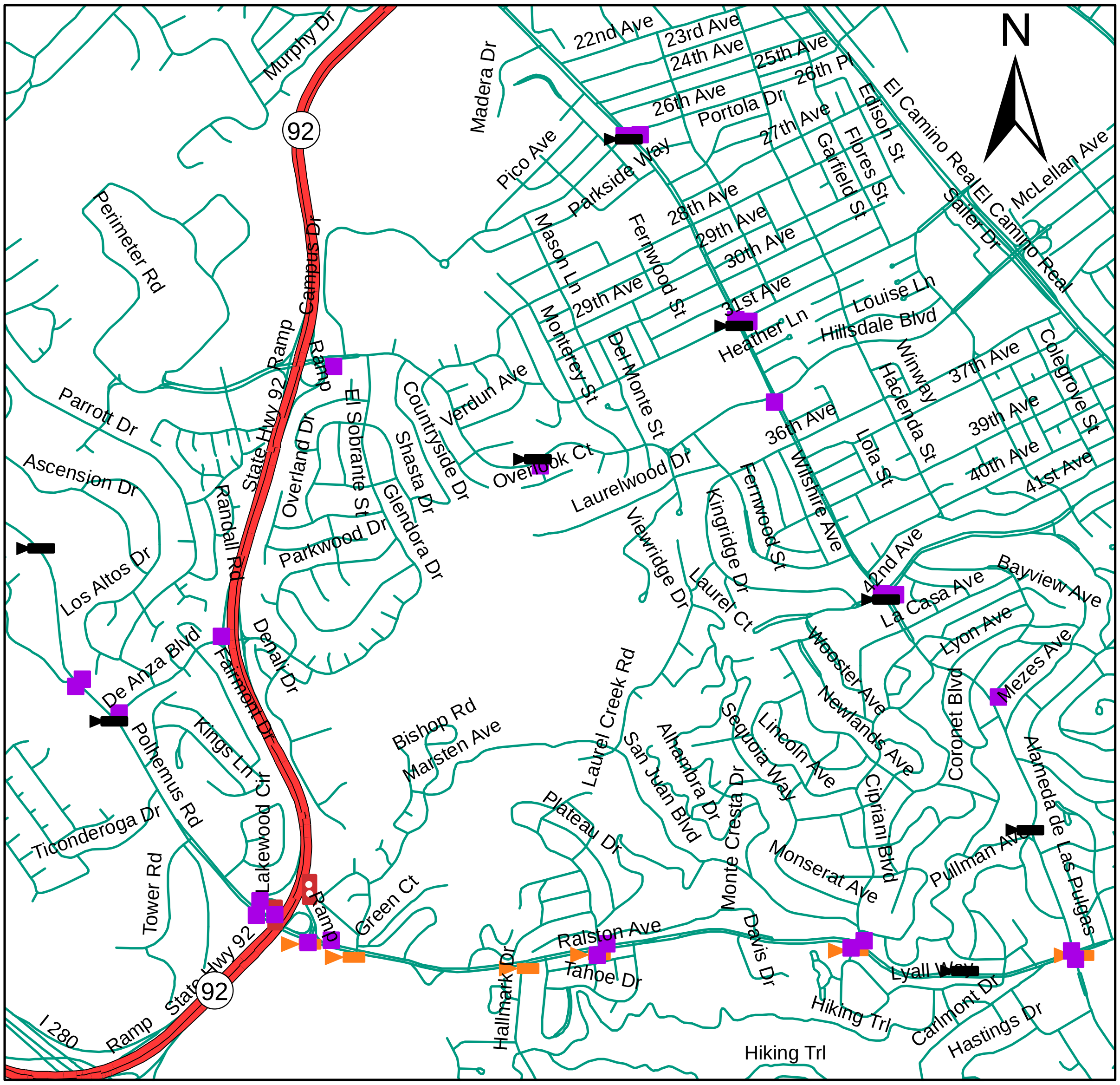
ESTIMATED PROJECT COST:
CONSTRUCTION COST: $ 1, 729,375
ENGINEERING COST: $ 300,000
SOFTWARE DEVELOPMENT COST: $ 60,000

TOTAL IMPLEMENTATION COST: $ 2, 089,375

REVISION DATE 1/22/08

Project Information Sheet

Project 16



LIMITS:
State Route 92 from Ralston Ave to Alameda de Las Pulgas; Alameda de Las Pulgas from State Route 92 to Ralston Ave; Ralston Ave from State Route 92 to Alameda de Las Pulgas; Hillsdale Blvd from State Route 92 to Alameda de Las Pulgas; Polhemus Rd

Legend

- RAMP METERS
- TRAILBLAZERS
- PTZ CAMERAS
- FIXED CAMERAS

AGENCIES:
SAN MATEO
FOSTER CITY

ALTERNATE ROUTES:
92-W-11-1, 92-W-9B-1, 92-E-9A-1, 92-E-10-1, 92-E-11-1

NEW FIELD ELEMENTS:
PTZ CAMERAS - 7
FIXED CAMERAS - 7
TRAILBLAZERS - 25
RAMP METERS - 2
CONNECTOR CONTROLLERS - 3

AT GRADE CROSSINGS - 0
SYSTEM DETECTION - 0
EVP LIGHT TRANSIT - 0
EVP HEAVY TRANSIT - 0

INFRASTRUCTURE TYPE:

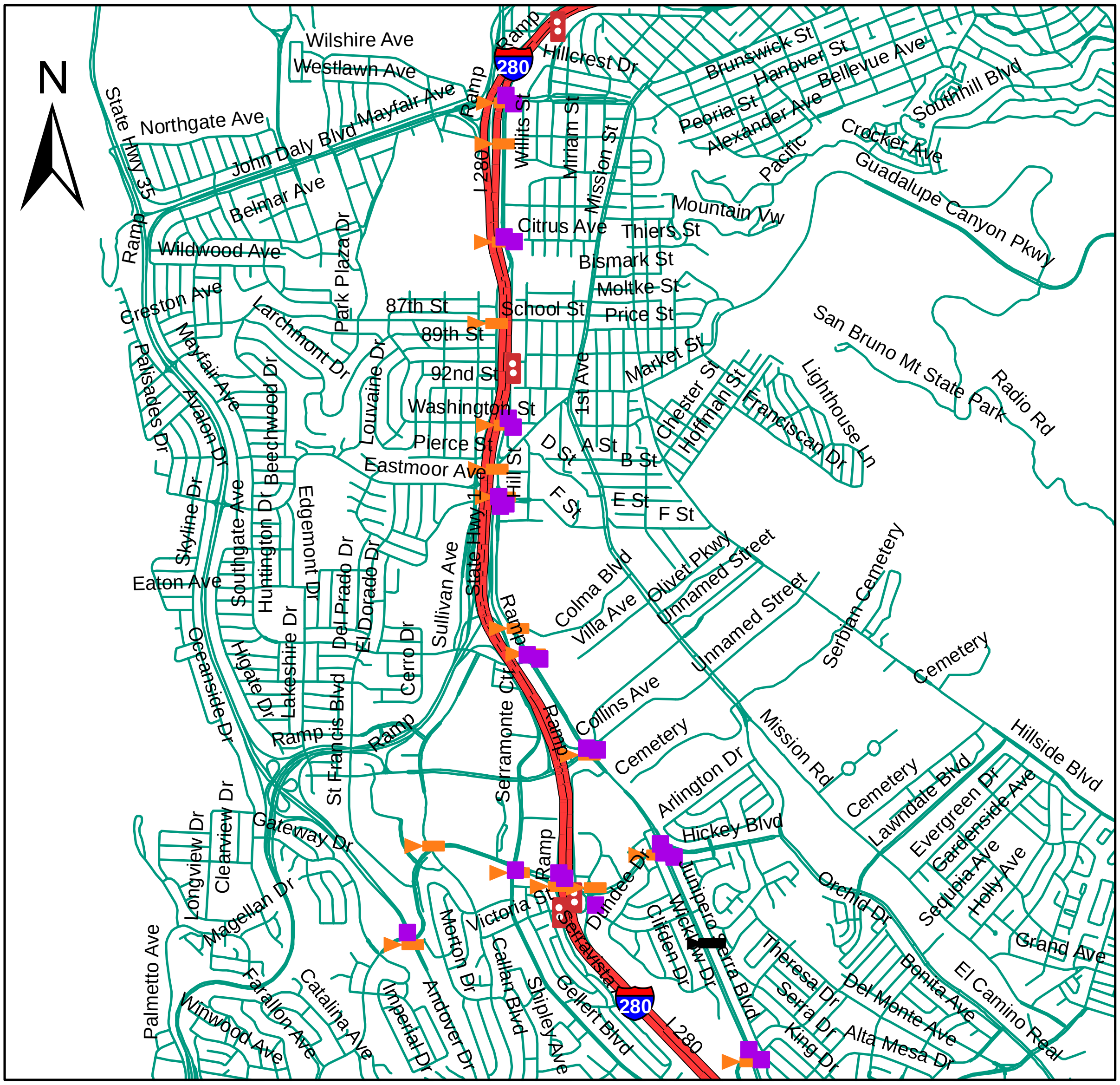
ESTIMATED PROJECT COST:
CONSTRUCTION COST: $ 2, 820,375
ENGINEERING COST: $ 500,000
SOFTWARE DEVELOPMENT COST: $ 75,000

TOTAL IMPLEMENTATION COST: $ 3, 395,375

REVISION DATE 1/22/08

Project Information Sheet

Project 17



LIMITS:
I-280 from Hickey Blvd to John Daly Blvd; Junipero Serra Blvd from John Daly Blvd to Westborough Blvd; Hickey Blvd from Skyline Blvd to Junipero Serra Blvd

Legend

RAMP METERS

TRAILBLAZERS

PTZ CAMERAS

FIXED CAMERAS

AGENCIES:
DALY CITY
SOUTH SAN FRANCISCO
COLMA

ALTERNATE ROUTES:
280-N-46-1, 280-N-47-1,
280-S-49-1, 280-S-47B-1

NEW FIELD ELEMENTS:
PTZ CAMERAS - 1
FIXED CAMERAS - 20
TRAILBLAZERS - 23
RAMP METERS - 4
CONNECTOR CONTROLLERS - 0

AT GRADE CROSSINGS - 0
SYSTEM DETECTION - 0
EVP LIGHT TRANSIT - 0
EVP HEAVY TRANSIT - 0

INFRASTRUCTURE TYPE:

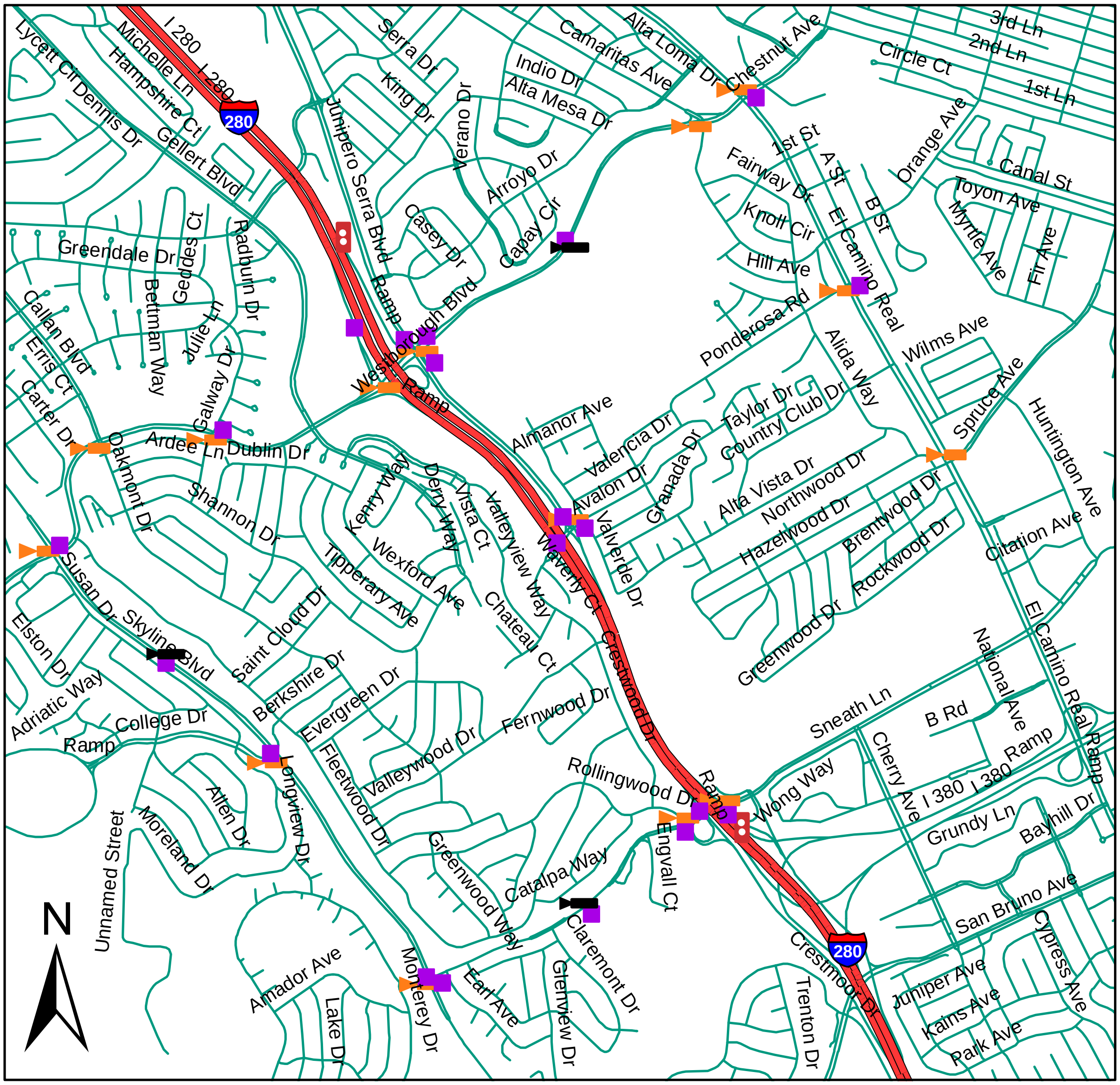
ESTIMATED PROJECT COST:
CONSTRUCTION COST: $ 2, 681,940
ENGINEERING COST: $ 470,000
SOFTWARE DEVELOPMENT COST: $ 75,000

TOTAL IMPLEMENTATION COST: $ 3, 226,940

REVISION DATE 1/22/08

Project Information Sheet

Project 18



LIMITS:
I-280 from Westborough Blvd to Sneath Ln; Westborough Blvd from Skyline Blvd to El Camino Real; Skyline Blvd from Westborough Blvd to Sneath Ln; Sneath Ln from Skyline Blvd to I-380

Legend

- RAMP METERS
- TRAILBLAZERS
- PTZ CAMERAS
- FIXED CAMERAS

AGENCIES:
SAN BRUNO
SOUTH SAN FRANCISCO

ALTERNATE ROUTES:
280-N-43A-1, 280-N-44-1,
280-S-46-1, 280-S-45-1

NEW FIELD ELEMENTS:
PTZ CAMERAS - 3
FIXED CAMERAS - 16
TRAILBLAZERS - 21
RAMP METERS - 2
CONNECTOR
CONTROLLERS - 0

AT GRADE CROSSINGS - 0
SYSTEM DETECTION - 0
EVP LIGHT TRANSIT - 0
EVP HEAVY TRANSIT - 0

INFRASTRUCTURE TYPE:

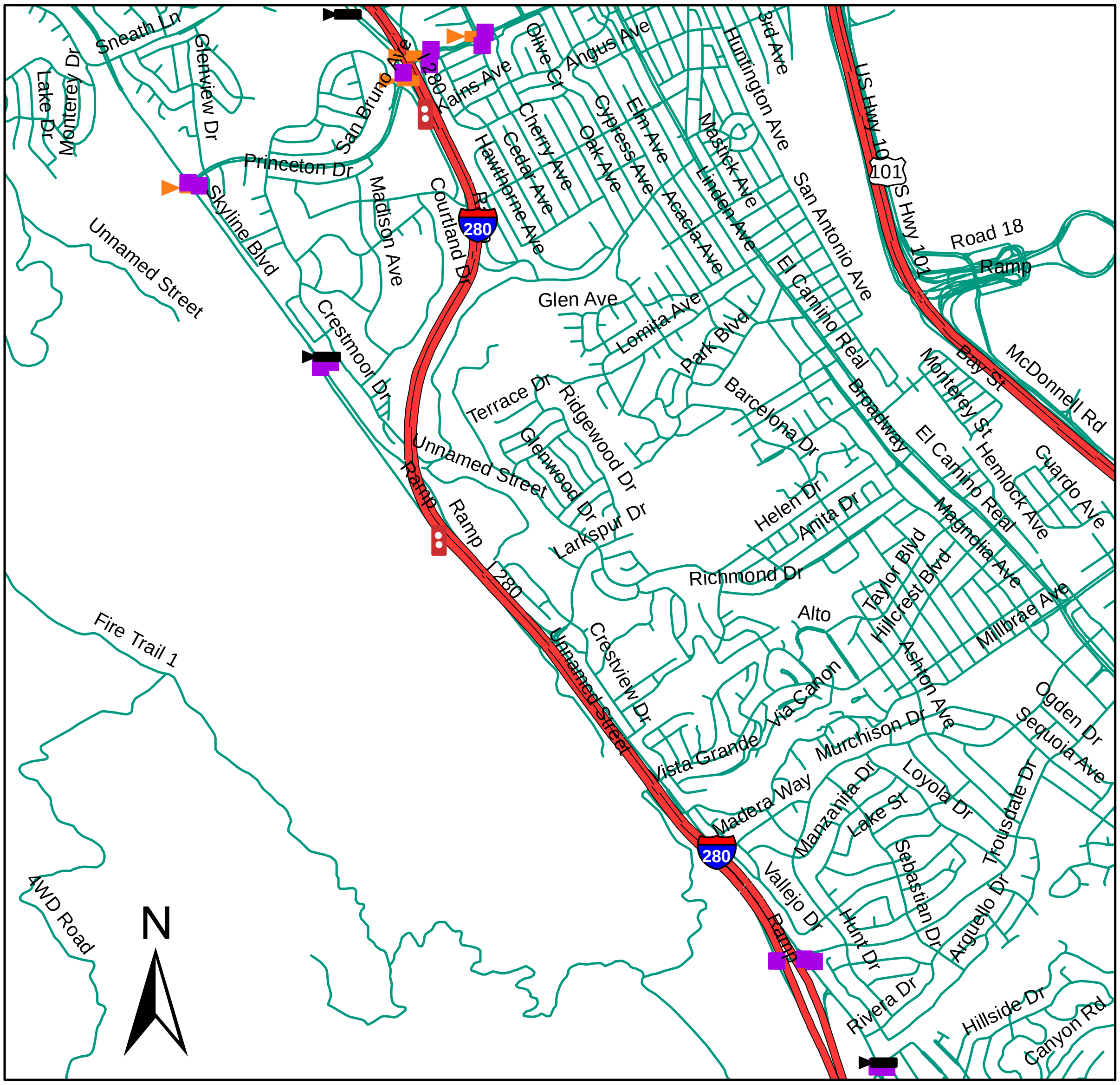
ESTIMATED PROJECT COST:
CONSTRUCTION COST: $ 2, 499,815
ENGINEERING COST: $ 440,000
SOFTWARE DEVELOPMENT COST: $ 75,000

TOTAL IMPLEMENTATION COST: $ 3, 014,815

REVISION DATE 1/22/08

Project Information Sheet

Project 19



LIMITS:
I-280 from I-380 to Trousdale Dr; San Bruno Ave from Skyline Blvd to Cherry Ave; Skyline Blvd from San Bruno Ave to I-280

Legend

RAMP METERS

TRAILBLAZERS

PTZ CAMERAS

FIXED CAMERAS

AGENCIES:
SAN BRUNO
MILLBRAE
HILLSBOROUGH
SAN MATEO
SOUTH SAN FRANCISCO

ALTERNATE ROUTES:
280-N-40-1, 280-N-41-1,
280-S-43B-1, 280-S-41-1

NEW FIELD ELEMENTS:
PTZ CAMERAS - 4
FIXED CAMERAS - 4
TRAILBLAZERS - 14
RAMP METERS - 2
CONNECTOR
CONTROLLERS - 0

AT GRADE CROSSINGS - 0
SYSTEM DETECTION - 0
EVP LIGHT TRANSIT - 0
EVP HEAVY TRANSIT - 0

INFRASTRUCTURE TYPE:

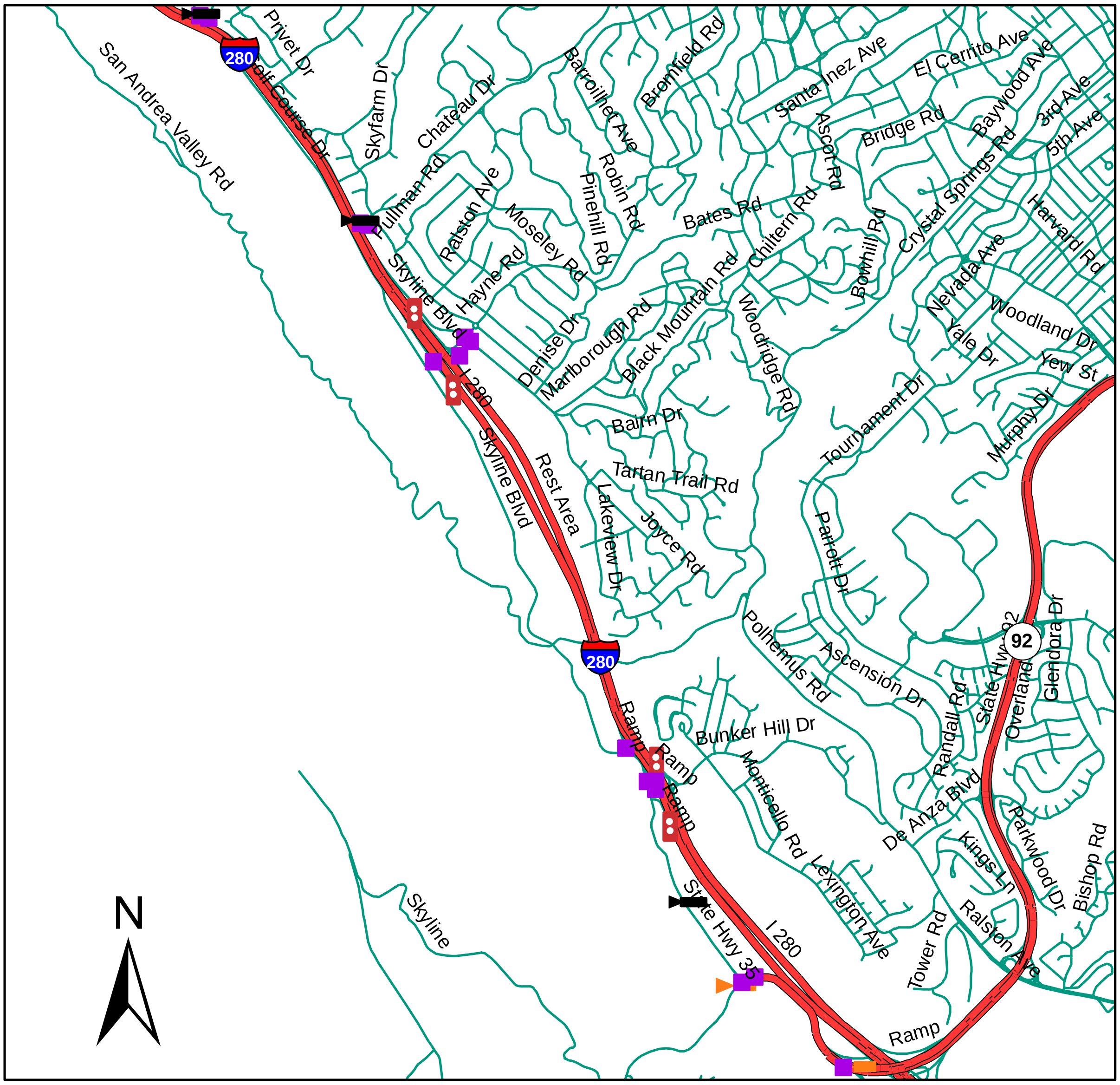
ESTIMATED PROJECT COST:
CONSTRUCTION COST: $ 1, 707,750
ENGINEERING COST: $ 300,000
SOFTWARE DEVELOPMENT COST: $ 75,000

TOTAL IMPLEMENTATION COST: $ 2, 082,750

REVISION DATE 1/22/08

Project Information Sheet

Project 20



LIMITS:
I-280 from Trousdale Dr to State Route 92; Skyline Blvd from Trousdale Dr to State Route 92

Legend RAMP METERS TRAILBLAZERS PTZ CAMERAS FIXED CAMERAS	AGENCIES: HILLSBOROUGH SAN MATEO ALTERNATE ROUTES: 280-N-33-1, 280-N-34-1, 280-N-36-1, 280-S-39-1, 280-S-36-1, 280-S-34-1	NEW FIELD ELEMENTS: PTZ CAMERAS - 5 FIXED CAMERAS - 2 TRAILBLAZERS - 14 RAMP METERS - 4 CONNECTOR CONTROLLERS - 0 AT GRADE CROSSINGS - 0 SYSTEM DETECTION - 0 EVP LIGHT TRANSIT - 0 EVP HEAVY TRANSIT - 0 INFRASTRUCTURE TYPE: **ESTIMATED PROJECT COST:** **CONSTRUCTION COST: $ 1, 713,065** **ENGINEERING COST: $ 300,000** **SOFTWARE DEVELOPMENT COST: $ 75,000** **TOTAL IMPLEMENTATION COST: $ 2, 088,065**

REVISION DATE 1/22/08